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THE

# Elaboratory laid open,

OR, THE

# SECRETS

OF

# MODERN CHEMISTRY

AND

# PHARMACY

REVEALED:

*Containing many Particulars extremely neceſſary to be known to all Practitioners in Medicine.*



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# PREFACE.

THE particulars, which make the principal contents of the following pages, were known to me in conſequence of ſome opportunities, that ſeldom happen to any, who are willing to impart to the public, what they learn of this kind: a minute knowledge of ſuch matters being, almoſt wholly, confined to thoſe, who are lucratively engaged in the buſineſs they relate to; and who, therefore, have very ſtrong reaſons againſt revealing them to the world; as their profits, in a great meaſure, depend on keeping the ſecrets of this ſort, in few hands. Nor is there indeed, any individual, amongſt thoſe moſt verſed in the practice of chemiſtry and pharmacy, who can boaſt of being acquainted with more than a part of what I have here collected, or communicated; as each has only a certain ſhare of Arcana; and is, in general, even no further maſter of them, than in barely being able to perform the proceſſes, by certain ſtated means; without any deeper intelligence either of the nature of the operation or ſubject: and ſome of the very material articles, moreover, have not, as far

as I am informed, been hitherto known to, or practiſed by, any other perſon than myſelf; though, from a very ſufficient experience, I am fully convinced of their utility.

It having happened to me, however, from my indulging a great fondneſs for every branch of medicinal knowledge, and ſome peculiar circumſtances of ſituation favourable in this particular point to my deſire, to become appriſed of almoſt all the more ſecret practices, uſed by thoſe who prepare or vend medicines, I conceived it might be beneficial to the public to make them known; and to give the world a more juſt and full view of the methods, by which the greateſt part of the chemical medicines to be commonly met with are prepared, than had been before done; eſpecially, if the proceſſes were illuſtrated with ſuch obbſervations, on the nature of the ſeveral ſubjects, and manner of operating, as might enable any, who would take the pains to underſtand what I have laid before them, to vary each proceſs, in ſuch manner as may ſuit any particular purpoſe or occaſion; or to judge with greater certainty of the genuineneſs or perfection of any medicines, they may receive from the hands of thoſe who prepare or ſupply them.

Others have, indeed, frequently profeſſed, to have done the ſame in ſome degree, both in books, and courſes of lectures: but they, who have been moſt qualified to treat theſe matters ſpeculatively, have ſeldom had any

very accurate information of the real methods of management, in the elaboratories of thoſe few great dealers, who almoſt monopolize the preparation of the greateſt part of the conſiderable articles of the chemical claſs of medicines: while they, on the other hand, who have been moſt largely concerned in the practice, have found themſelves very little capable of extenſive ſpeculation; as it muſt, neceſſarily, be the reſult of reſearches, conducted by more profound and abſtracted principles than come within their cognizance.

I have therefore, availing myſelf of the advantages, that have fal'n to my lot, with reſpect to both thoſe kinds of knowledge, eſſayed to give a juſt and critical view of the preſent ſtate of the operative pharmacy, eſpecially as it depends on chemiſtry: and to ſhew, how the common preparation of medicines, particularly thoſe of the retail chemiſts and druggiſts, who are furniſhed with almoſt every article they vend by the wholeſale preparers of, or dealers in them, as alſo nearly the whole of what is ſent into the country, differs from the regular and orthodox preſcriptions. That all the perſons, trading either in a more extenſive or confined way in medicines, being put on the ſame level, with reſpect to the arts uſed in the preparation of them, may regulate their proceedings accordingly; and not lye under a neceſſity of repoſing an implicit confidence in others; of which in general, advantages, not very fair, however cuſtomary, are taken.

In the profecution of this defign, I found it neceffary, in order to the rendering intelligible what I would communicate, to go further than meerly giving a hiftory of the methods practifed for the more profitable preparation or fale of medicines; or detached obfervations on them. I therefore have prefixed an introductory eflay, on the improvements of the inftruments and general methods fubfervient to the intentions both of chemiftry and pharmacy: as alfo an examination into the fameneſs of the real nature of feveral fubftances in the materia medica, which go under different names, and are fuppofed to have an eſſential diverſity: that it may be more readily underſtood, on what grounds, fubftitutions are deemed fit to be permitted: and I flatter myſelf, that this part of my work may have a further benefit, than the bare elucidation of the fubfequent matter; as it may tend to inculcate a deeper knowledge of principles, which, though extremely requifite to all who concern themfelves with the preparation of medicines, is yet almoft univerſally wanting in them.

Whatever fucceſs I may have, in attempting to give new lights into the modern practice of this part of pharmacy; I fhall not, I am afraid, be thanked by thofe, who are moft largely concerned in the preparation, or fale of medicines, for the whole of this work: as nothing can be more diſagreeable to any fuch body of men, than to have the myſteries of their art, or trade, diſplayed to the world: but if they would reflect

flect what treatment any ſpeculative perſon, who had made the moſt conſiderable diſcoveries, would meet with from them, if he endeavoured to reap a benefit from his ſtudies, in any way where they ſhould be concerned; they would find no room to complain, becauſe he gave himſelf the pleaſure of imparting, to the public, the fruits of his labour for the general good of mankind; when all other means of advantage were denied to him, through their oppoſition, or ſelfiſh conduct, ſhould he go about to ſeek any. I could furniſh very ſtrong inſtances in ſupport of the truth of this ſuggeſtion, if the common maxims of trade did not put it out of doubt.

However, the greater dealers in medicine (to all of whom, I diſclaim the leaſt obligation, and againſt ſome of whom, I have the juſteſt cauſe of reſentment,) may take umbrage at the liberty, I aſſume, of laying open the ſecrets of their trade, the more retail venders will, I am certain, be greatly obliged to me: ſince, I put it in their power either to inſiſt, in many caſes, on a more perfect commodity; or to ſave ſixty or eighty per cent. by preparing, themſelves, the ſame they are now ſupplied with; as well as to diſtinguiſh, in other articles, how far the prices, charged to them, correſpond with the quality of what they buy.

But it was not for the benefit or pleaſure, of either the wholeſale or retail preparers, or venders of medicines, I principally intended this work: the whole body of practitioners in phy-

ſic are greatly intereſted in this kind of information; and ſome claſſes have very little opportunity of furniſhing themſelves with it, however neceſſary. It is, therefore, to thoſe who preſcribe or adminiſter medicines, as well as to thoſe who prepare or ſell them, I deſign to make this collection uſeful: that knowing the real manner of preparation of what they may generally meet with, as well as the common ſubſtitutions and adulterations, with the nature of each, and means of detecting them, they may guard againſt material impoſitions; and yet not give themſelves the unneceſſary trouble, of combating deviations from meer forms, where there is no eſſential reaſon for a ſtrict compliance with them.

It may be ſaid, that ſeveral of the particulars, I have introduced, are not diſcoveries of new matter; having been before mentioned, in the works of others, though ſomewhat differently. I admit the charge; but, in my juſtification, alledge, that few of theſe have been treated of, in ſo full and diſtinct a manner, as was neceſſary to render them uſeful in practice: as they have, for the moſt part, been only touched on ſlightly, in ſome of theſe voluminous compilements of common proceſſes, and trite obſervations on them, which have been ſo multiplied, that both the time loſt in peruſing often the ſame matter, and the expence of purchaſing ſuch a number of books, on the ſame ſubject, alike in the greateſt part of their contents, have prevented the ſmall portion of them, which, is new, from being

being known to many. I hope, therefore, it will be allowed, to be neither unfair or improper, to have given a place here, in a more explicit view, to ſuch of theſe particulars as may be conſidered real improvements; even though they have been before hinted at, in the corner of ſome other book; and with regard to ſuch others as concern what ought to be exploded out of practice, I have mentioned them, in order to explain intelligibly the means, by which they may be diſtinguiſhed. Some things, indeed, I have found it unavoidable to take in, though without any plea of novelty; becauſe they were wanting to complete the ſyſtem, ſo far as was neceſſary for the illuſtration of the other parts: as, particularly, I found it neceſſary, in order to ſhew clearly the comparative advantage or impropriety of the private methods of preparing the ſeveral medicines, with the regular and authorized proceſſes, to inſert the latter; which, for the brevity of the work, I ſhould otherwiſe rather have choſen to have left out. But, after all, I have been the greateſt plagiary againſt myſelf; the moſt material part of the theft, I have committed, being from my own performances.

There are ſome articles uſually prepared, by thoſe who practiſe medicinal chemiſtry, that are chiefly uſed by the farriers; as the crocus metallorum, and white precipitate, as made by the old proceſſes: and there are, alſo, others, of which, the greateſt or whole conſumption is in purpoſes intirely foreign to medicine;

dicine; as the oil of vitriol, aqua fortis, yellow arſenic, &c. but I thought proper, to take them all into my collection, where I could impart any material ſecrets relating to them; ſince it may be of advantage to thoſe, who, by dealing in medicines, are ſometimes almoſt unavoidably led to deal in theſe preparations likewiſe: and, as the lights, I ſhall give concerning them, tend alſo to illuſtrate the general principles of chemical knowledge, and the whole I ſay of them does not occupy any great part of the book, I hope others will excuſe me.

It may, probably, be remarked, by thoſe, who are leſs intereſted in that part of this work, which regards the teaching how to conduct the chemical proceſſes with extraordinary profit and diſpatch, that I have deſcended to too minute particulars; and taken up too much room in the detail of matters, not univerſally inſtructive: eſpecially in the obſervations, I have made, with reſpect to the operations in general, and the directions for the conſtructing of furnaces, and other parts of the apparatus. But thoſe, who look into this book with a more ſpeculative taſte, muſt paſs over this part; and excuſe it for the ſake of others, who, having the advantages attending the practice more immediately in their regard, may greatly profit by it. And I can venture to affirm, that many of thoſe cautions, which may ſeem moſt trivial on a ſlight view, will, on experience, be found of very high conſequence in the conduct of the

operations, where large concerns come in queſtion: for the quantity of what is produced, as well as the reduction of the expence, are no leſs material, in a commercial light, than the quality. Nor is there perhaps any, that ſhall have occaſion to build or refit an elaboratory, but who may reap a benefit by conſidering the inſtructions I have laid down with relation to the furniture of it: as they are neither founded on conjectural reaſonings, nor an implicit confidence in the common uſage; but on an experimental knowledge of the ſubject, they concern, acquired by many expenſive trials of a variety of methods, aided by a cloſe ſtudy of thoſe principles which lead to a juſt theory. In giving ſuch inſtructions on this head, as can at all avail in practice, it is unavoidable to be very circumſtantial in every material point. For, from an ignorance of one neceſſary part of what is to be done, the whole may be found impracticable, to thoſe, who have no guide but the directions before them: and I have, therefore, endeavoured to lead ſuch, as take upon them the ſuperintendance of this neceſſary work, ſo ſtep by ſtep, to the right execution of it, that, without previouſly conceiving what the whole ſtructure may be when finiſhed, they may proceed, in the due formation of the ſeveral parts, free from the leaſt perplexity or embarraſſment.

I may probably, be, likewiſe, charged, with not having intirely acquitted myſelf of the promiſe, implied in the title of this work, becauſe,

I have concealed ſome particular practices, in the ſophiſtication of medicines, which, I acknowledge myſelf to be informed of. But, as the deſign of this part of the book was, to diſcover and explode impoſitions, and not to introduce or propagate them, I thought it much better, to ſuppreſs a few of thoſe, which are moſt injurious, and moſt likely to be perſued by perſons now ignorant of them; and, inſtead of ſhewing how they may be effectuated, to teach only the method of detecting them. For I am afraid, a greater attention may be given, to what I exhibit of this kind, by thoſe, who are inquiſitive after ſuch wicked arts, in order to reap a perſonal benefit from adopting them, than by thoſe, who can have no other motives to ſeek this ſort of knowledge, but the good the public may derive from their detecting them: and, to the latter claſs, it is indeed ſufficient, to underſtand what relates to this only.

I could have written a more methodical and comprehenſive treatiſe, on the ſubject I have taken in hand, had I gone into a more general diſquiſition of every thing relating to it: but as my deſign was to ſupply only what ſeemed hitherto wanting, I reduced my plan to ſuch a form, as might beſt avoid the repetition of what has been already frequently ſaid, and confined my view to ſuch particulars only, as are either not to be found elſewhere, or would yet well bear a further elucidation. This being the ſole object of my perſuit, I contented myſelf with the giving up the elegance

gance of the compoſition for the utility of conciſeneſs; and to place the merit of the book, rather in the choice of the matter, than the extenſiveneſs of the plan: as I think I may ſafely give the readers, the ſatisfaction of this aſſurance; that, if this book does not contain every thing relative, in a general view, to the ſubject, which is to be found in ſome others before publiſhed, it, nevertheleſs, contains ſome very material articles, that are not to be found in any.

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ERRATA.

Page 17, line 12, for *it was therefore owing to these obscure*, read, *it was, therefore, to these obscure.* P. 137, l. 16, for *four ounces*, r. *four pounds.* P. 145, l. 16, for *spirit of alcohol*, r. *spirit or alcohol.* P. 179, l 4, for *as well that*, r. *as well as that.* P. 197, l. 6, for *lac sulphuris*, r. *lac sulphuris.* P. 198, l. 8, for *sal sulphuris*, r *lac sulphuris.* P. 246, l. 10, for *fictitious cinnabar*, r. *factitious cinnabar.* P. 249, l. 3. for *tile be laid over*, r. *tile being laid over.* P. 253, for *cinnabar butter*, r. *cinnabar and butter.* P. 287, l. 11, for *for the solution*, r. *or the solution.* P. 304, for *fictitious Roman vitriol*, r. *factitious Roman vitriol.*

# PART I.

## INTRODUCTION.

Explaining the general matters previouſly neceſſary to be known, both with reſpect to the operations, and ſubject of them, in order to the more ready comprehenſion of the ſubſequent particulars.

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## SECTION I.

*Deſcription of ſeveral improved parts of the chemical apparatus, conducing to the more quick and expedite manner of performing many of the proceſſes.*

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THE firſt attention, neceſſary to the performing, with moſt eaſe and profit, the ſeveral operations of chemiſtry and pharmacy, is, the inſtruments employed in them; for, on the perfection of theſe, depend not only the quick diſpatch of the buſineſs undertaken, but alſo conſiderable ſavings in labour, fewel, and frequently the produce of the operation. It is, indeed, to happy inventions reſpecting this point, that great part of the advantage of the preſent prac-

tice over the former lies; and that ſome few particular perſons have been able to afford medicines, even though duly prepared, at extreme low prices. So that, without being well informed of the inſtruments, by which compendious proceſſes may be performed, general directions, for the conducting them, would in many caſes be of very little avail: and to deſcribe the ſtructure of each of ſuch as ſerve for a variety of purpoſes, or to ſhew the principles of its general utility, on every particular occaſion, would lead into a detail repetition, tediouſly immethodical. I ſhall, therefore, here endeavour, to point out all thoſe particulars, relating to the beſt conſtruction and formation of the ſeveral parts of the apparatus, which give any ſuperiority over the common methods; as well ſuch as have been practiſed in a ſecret way by others, as thoſe, which my own reaſoning and experience have led me to the knowledge of; avoiding at the ſame time as much as poſſible to dwell on any matters, which are commonly known; as my preſent buſineſs is not to teach the whole art of pharmacy, but only to impart thoſe improvements, that have either been intirely concealed hitherto, or well underſtood only by ſome few.

But, however neceſſary it may be to the completion of my purpoſe, it is extremely difficult to give ſuch deſcriptions in words, however multiplied, of any new parts of an apparatus, for purpoſes of this kind, as may enable thoſe, who have never ſeen them, to conceive their

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ſtructure and uſe clearly enough, to introduce them into practice; nor do engraved deſigns greatly aſſiſt in this point; for, though they convey a general idea of the figure, yet they help but little in teaching how to form or conſtruct machines of a more complex kind. On which account, I ſhall endeavour, firſt, to lead to a diſtinct notion of the improvements, I ſhall attempt to teach, by ſhewing the defects and impropriety of the ſame ſubjects, according to the methods at preſent in uſe: that, by thus reaſoning on what is already underſtood, I may facilitate the comprehenſion of the principles on which a greater perfection may be founded: and, having thus introduced a general notion of what I would recommend, I ſhall ſubjoin particular directions for the practice of it.

## *Of furnaces in general, with the defects of thoſe at preſent in uſe.*

The principal, and moſt critical, part of the apparatus ſubſervient to pharmacy is, the furnaces employed for the preparation of thoſe medicines, which come within the chemical claſs: as the ſtructure of theſe is more complex, and the uſes they are applied to of a more nice and difficult nature, by far, than any other of the operations regarding this art. It is therefore neceſſary, that they ſhould be well deſigned, and judiciouſly executed; otherwiſe their defects greatly enhance the expence, and fruſtrate the intention, of the operations they

are to perform; beſides their being extremely liable to become, in a very ſhort time, out of repair and uſeleſsly ruinous.

It is proper, therefore, that careful and able men ſhould be employed in the fabrication of furnaces; though ſuch are rarely to be found among common workmen: but the moſt likely to ſucceed are thoſe, who have either been employed before in the ſame buſineſs, or have been accuſtomed to ſet coppers for houſhold purpoſes. When the beſt qualified, however, are ſet to work, they ſhould be continually ſuperintended by the operator, or ſome perſon capable of judging, both of their adherence to the plan given, and general performance of the work. For, if the parts of furnaces, that are expoſed to much heat, be not made extremely compact; but are patched up of mortar and bricks, that are not fitted in every part to each other, (as bricklayers are very apt to do from the habits they acquire by being employed in coarſer buildings) the mortar will very ſoon calcine, and ſhrink, in ſuch faulty places; and make ſuch vacuities and inlets to the air, as render the furnace incapable of doing properly its office, to the great delay and, ſometimes, deſtruction of the proceſs.

The materials are the next object of attention; and they ought to be well choſen, and perfect of their kind. Common bricks, with good mortar made with lime and coal aſhes, well mixt and beaten together, will ſerve for thoſe parts, which are not liable to be heated

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red hot; but where that degree, or a greater, may happen, Windſor bricks and Windſor loom, or Sturbridge clay, and lime, or, where the fire may be very violent, the compoſition, called the fire lute, (hereafter mentioned) ſhould be uſed. And as the Windſor bricks are of a texture, which admits of it, they ſhould be ſo worked to fit each other, as to form one compact body with ſcarcely any joints at all.

Particular care ſhould be likewiſe taken, in the drying of furnaces. For the beſt deſigned or conſtructed may be eaſily ſpoiled by any miſmanagement in this point; as is very frequently the caſe, where the uſe of them being wanted, as generally happens, before they are ready, they are not allowed a proper time. The interior part ſhould be, therefore, ſuffered to ſettle and dry, for ſome days, before the cavity be cloſed in by finiſhing the upper: and, after that part alſo be become pretty firm, they ſhould be gradually warmed by a ſmall charcoal fire, made, either in the body of the furnace itſelf, or in the aſh-hole under it. After this has been ſome time continued, and the mortar appears hard in the interior ſurface, a coal or wood fire may be made, of a gentle degree at firſt; and increaſed ſlowly, as the ſmcking of the furnace may indicate to be proper. But the more leiſurely this proceeds, the more durable and perfect will be the furnace.

Notwithſtanding the great importance of commodious furnaces to the practice of the chemical pharmacy, the methods, in general

uſed for their conſtruction, are ſurprizingly defective: and in purſuance, therefore, of the deſign, I have propoſed, of illuſtrating the directions, for the execution of the improvements I offer, by pointing out the faults in the ſame ſubjects according to the manner now in practice, I will endeavour to ſhew the ſeveral errors committed with regard to them; and hint on what principles they may be avoided: reſerving, however, the more particular explanation of the proper remedy, in each caſe, till I come to give the improved plan for the conſtruction of the ſeveral particular kinds.

The firſt and moſt obvious fault is the diſpoſing the fireplace in the midſt of the furnace, inſtead of putting it under the center of the object, intended to be heated. By which means, the fire exerts its greateſt force on the column of brick over it; calcining and deſtroying all that part of the furnace, without an equivalent effect on what it is intended to act upon. This improper diſpoſition of the fire may, however, be eaſily avoided, and a right ſituation ſubſtituted, if the worm flew be omitted; and the other methods followed, which I have given in the particular plans: and as the inconveniencies, reſulting from this error, extend as well to thoſe of ſtills and boilers, as of other furnaces, an undue conſumption of fewel, and quick deſtruction of the furnace, being always diſadvantageous, it will be found worth while to endeavour to remove them in all caſes; eſpecially, as it may be done without

out producing any other; except, where immenſely large veſſels are in queſtion; which require unavoidably a ſupport of brickwork under them.

The next fault, in the preſent ſtructure of furnaces, is the want of ſome proper inlet for feeding the fire, without having occaſion always to open the door for that purpoſe. For, where the fewel can only be thrown in at the door, there is a neceſſity for having the area of the fireplace large, otherwiſe a ſufficient quantity cannot be made to lie in it; as, if it be ſmall, the coals tumble out, whenever it is filled to any greater height, every time the door is opened. Now the diſadvantages, conſequential to the having the fireplace too large, are manifold. For if the ſpace, occupied by the bars, be great, and the whole area, they make, be covered with coals, the heat will be too ſtrong on many occaſions; and, if it be not covered, a falſe draught is made, which greatly weakens both the degree and effect of the fire proportionably to the quantity of fewel: as the influx of the air will be the greateſt through the naked part of the area, which much weakens the draught through the coals, at the ſame time, it greatly refrigerates both the furnace and its contents: ſo that, not only a great waſte of fewel is made, but the latitude in the degrees of heat, and means of accommodating it to the occaſion, which are to be had in furnaces well conſtructed, are here greatly limited. This defect may be remedied by making a pro-

per hole, ſloping towards the fire, ſome inches above the ſurface of the fewel when at the higheſt: it muſt be lined with an iron frame, ſuch as is, with its ſtopper, below deſcribed, and may be in dimenſions about four inches long and three high; and ſituate in the front of the furnace, directly over the opening for the door and aſh-hole. Through this hole, the fire may be fed by a ſhovel of a fit ſize and figure, or ſtirred with a poker properly bent, without uſing the door for thoſe purpoſes; which need therefore only to be opened, for the making or lighting the fire, or the freeing the bars, from the ſcoria or clinkers, when they are choaked up with them. When the hole is not opened occaſionally, the ſtopper muſt be kept in; which ſhould ſo fit, as to make the ſide of the furnace equally intire as if there were no ſuch hole. This manner of feeding the fire will be found a very great convenience to thoſe, who are accuſtomed to it: as the effectual draught of the furnace may be thence greatly increaſed, the lighting the fire much facilitated, and the operator likewiſe enabled to have what body of fewel he pleaſes in the furnace, and to adequate the heat, with certainty, to any occaſion, without either being ſubject to have the fire extinguiſhed, when it is kept low, or not admit of being raiſed high, without the falling out of the coals, already in the furnace, every time he attempts to throw in a freſh ſupply. When this device is uſed, the area of the bars may be diminiſhed at leaſt one half;

and

and the conſumption of fewel will be leſſened much more than in that proportion, for the reaſons before given; nor will the operation be checked, on any neglect of the operator in keeping up the fire; as is liable to happen, when furnaces are built in the common way.

Another great error in the building furnaces, particularly thoſe for harts-horn pots, or ſand-pots, is the carrying the fire round the object, to be heated, in a vermicular flew, or worm (as it is commonly called); by which means, the veſſel intended to be heated is much longer before it attain a due degree of heat; as the principal force of the fire is exerciſed on that great maſs of brickwork, which forms the worm, and is brought into equal contiguity with the veſſel itſelf, in reſpect to the fire, with indeed a much greater ſurface expoſed to it; from whence it requires a proportionable quantity of fire to keep the whole in any ſtated degree of heat. Beſides the great delay, therefore, in the beginning of the operation, which cannot proceed till the whole maſs, that makes the worm, be brought to a certain heat, the due effect cannot be had, without the conſuming a much greater proportion of fewel, than if the heated veſſel hung in the open furnace. But there is yet another momentous inconvenience, ariſing from furnaces of this kind of ſtructure, where a ſtrong heat is wanted, which is, that the brickwork of theſe worms is extremely ſubject to be damaged, and fall to pieces: from whence the flew being choaked up, and the

draught

draught obſtructed, a neceſſity ariſes of taking down all that part of the furnace, if not the whole; and rebuilding it at a great expence; as there is no poſſibility of repairing it, under theſe circumſtances. An intire open cavity carried round the pot, ſtill, &c. formed by raiſing the brickwork, at an equal diſtance, on every ſide, and cloſing it in where no further heat is required, anſwers the end much better: ſuffering the proper object to be immediately ſurrounded by the fire; and placing it out of the contact of other bodies, ſo as to be capable of being independently heated; while the furnace itſelf is much leſs liable to be damaged, or can ſuſtain a ſmall degree of damage, without any material injury to its uſe; and even, when it is ſo injured as to require repairing, admits of it with greatly leſs trouble and expence, than when built in the other method.

The laſt fault, I ſhall take notice of, with regard to the common ſtructure of furnaces, is, the bad proportion of the chimnies; which, in general, are greatly too large. By making them ſo, the draught is much diminiſhed; and the ſoot ſuffered to be collected in a troubleſome manner. For, when the ſides of chimnies contain a greater area of ſurface than can be duly heated, the neceſſary rarefaction of the air, paſſing through, is deſtroyed; on which principle alone the draught of chimnies depends; and, the cavity being too large proportionably to the current of air, the force of it is ſo diminiſhed, that the ſoot, inſtead of being

blown

blown out, gathers and reſts on the ſides, till it obſtructs the paſſage; and, choaking up the draught, deadens the fire, eſpecially at the firſt lighting of it; by which means, the progreſs of the operation is ſometimes greatly retarded. Inſtead, therefore, of the wide proportion now made uſe of, if the chimney be intended for the uſe of one furnace only, a ſquare of ſix inches is fully ſufficient; and this may be increaſed, in an equal ratio, where it is deſigned for a greater number: and there will reſult this further advantage, from forming them on this proportion, that they will not require to be raiſed half ſo high, as when made in the common way.

*Of the iron-work neceſſary to be prepared, previouſly to the building furnaces in general.*

An iron door, with its frame, for the lighting the fire and taking out the ſcoria of the coals, is requiſite for moſt kinds of furnaces: but, as ſuch doors are commonly intended, for the further uſe of feeding the fire with fewel, they are made much larger than is neceſſary, if that method be, as I above adviſed, exploded. It is proper, always, to have them as long as the fire-place, or area made by the bars; but they need not be more than four inches high, where they are not deſigned to ſerve for feeding the fire. For, the lower they are, the leſs they will be capable of injuring the proper draught of air, through the fewel, by making a falſe one: and

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the leſs liable, alſo, they will be, themſelves, to warp and be out of order. They ſhould be made of hammered iron, and ſtrong. The uſual form will very well ſerve; if the latch, to keep them ſhut, be made bigger than common; and carried acroſs the whole door, to give it ſtrength to reſiſt the weight of the fewel; which, otherwiſe, when the iron is ſoftned by violent heat, forces the middle part outwards.

The form of the bars for bearing the fewel is, likewiſe, frequently faulty. The length muſt be always as that of the whole area of the fireplace; but the breadth ſhould be only a quarter of an inch: though, to give them a due ſtrength, they may be made half an inch, or more, deep. They ſhould be laid at a quarter and half quarter of an inch diſtance; and fixed firmly into two ſtrong croſs bars at each end of them: which croſs bars ſhould be ſufficiently long, to admit of their ſuffering the brickwork to have good hold of them; and ſhould be alſo beaten flat, at their ends, for that purpoſe. This faſtneſs of the parts to each other is neceſſary, in order to the tearing out, with leſs hazard, the ſcoria of the coals, which ſometimes choak the paſſage of the air betwixt the bars in a very detrimental manner: as alſo to make them bear to be ſtruck when clogged with aſhes: neither of which means, of aſſiſting the fire, can be practiſed, in common furnaces, without ſome hazard of diſplacing the bars, and putting the furnace into ſome preſent diſorder.

diſorder. The bars ſhould be of good hammered iron; becauſe it is difficult to procure them to be properly caſt, of due dimenſions, from pig iron: but if the bars and frame could be eaſily ſo procured, in one intire piece, they would anſwer extremely well; eſpecially where the heat is not ſo intenſe, as to hazard the melting any part of them.

A proper iron frame and ſtopper are neceſſary to be provided, for the hole through which the fire is to be fed with fewel, when the method of doing that by means of the door is not followed. The frame muſt be made of the ſize and form of the hole; which, as I obſerved before, may be four inches long and three high; or bigger where the furnace is large. It may be formed of four plates of a moderate ſtrength; of which, the two upper, muſt ſlope downwards to the fire, in the ſame parallel, according to the figure of the hole; and they muſt alſo project beyond their joining with the ſide plates, in order to their being fixed in the brickwork. The ſtopper ſhould be formed of five plates, put together in faſhion of a box (as in the doors of portable iron furnaces), and of ſuch figure and proportion as to ſlide into the hole, and fill it ſo exactly, as to render that part of the furnace intire, when it is not taken out occaſionally. The hollow of this box muſt be turned towards the fire, and filled with fire lute; and a handle ſhould be fixed in the middle of the inward part, for the more commodious uſe of it when

hot. This frame and ſtopper may be beſt made of hammered iron; as it is difficult to procure things of ſo complex a form to be caſt properly; and the ſtopper would likewiſe be neceſſarily heavier, if made of pig iron, on account of the unavoidable thickneſs of the parts of caſt work.

Plates, and broad bars, are alſo generally wanted, to be laid where brickwork is to be raiſed over the hollow parts of furnaces. Where larger plates are required, the cheapeſt and beſt way is to have them caſt of the exact dimenſions wanted: but, when a broad bar, or two, laid together, will anſwer the end, the eaſieſt way is to have them cut off, of a proper length, from the bars of hammered iron, at the ironmongers. Theſe plates, or bars, ſhould be procured, of a due magnitude, before the furnace be begun: the right proportion of them may be eaſily computed, by eſtimating the proportion of the parts of the furnace they are to be ſubſervient to; which ſhould be always carefully done; and the workmen apprized, by written inſtructions, of the ſize and meaſure of every thing, they are to erect, or put together.

## *Of the beſt manner of conſtructing furnaces for the ſand-pot and ſand-bath.*

This is the moſt important and uſeful ſort of furnace: which, I ſhall therefore treat of more particularly, becauſe, in the uſual way of building them, they are not only defective and faulty, in

all the general points before mentioned; but in others, alſo, reſpecting the proper proportion of this particular kind. This furnace is intended to ſerve, for the ſublimation of ſalts, and diſtillations of all kinds performed in retorts. It heats at the ſame time, when advantageouſly conſtructed, a ſand-pot and ſand-bath. In the firſt of which, any operation may be performed in one retort, where the degree of heat required is, from that of boiling oil to the firſt degree of glowing heat, or what is called red hot. In the latter may be performed any five ſeveral diſtillations, or diſtillations and digeſtions, where different degrees of heat are required, from that of boiling ſpirits of wine, to that of boiling oil; as the bath may be made large enough to contain five retorts, or other veſſels of the ſame magnitude; which, by being placed nearer or more remote from the ſand-pot, or fixed higher or lower in the ſand, may ſuffer the ſeveral degrees of heat each ſhall require.

The firſt ſtep, towards making this furnace, is, to procure a proper ſand-pot, and large plate for forming the ſand-bath. The ſize of the ſand-pot muſt be determined, by the magnitude of the retorts, or bodies, intended to be uſed in it. It muſt be ſo proportioned, as to hold the retort, and to allow about two inches ſpace for the ſand to ſurround it on every ſide. The beſt form of ſand-pots is, that of a cylinder with a concave bottom, which ought to be made double the thickneſs of the ſides; but the com-

mon

mon pots are generally made conical; I ſuppoſe, for the freeing them more eaſily from the moulds, they are caſt upon; and with thin bottoms, which ſubjects them to be very ſoon worn out if expoſed to a ſtrong heat.

The plate for the bath ſhould alſo be of caſt iron; and muſt be proportioned to the ſize, and number, of retorts or other veſſels, propoſed to be worked in it. It muſt be long enough, to allow at leaſt two inches ſpace betwixt every retort, and two inches and a half betwixt them and the ſides of the bath. For the breadth, the ſame proportion muſt be obſerved, with the addition of two inches for its bearing on the ſides of the hollow it is to cover. It may be as thin as it can be well caſt; but care muſt be taken, not to break it in the moving or fixing, which may otherwiſe very eaſily happen. A flat ring of iron of about three inches breadth, and of a proper magnitude to receive the edge of the pot into a proper groove, made in its own inner edge, ſhould alſo be provided. An iron door, with its proper frames, and bars, for the fire-place, as alſo an iron frame, and ſtopper, for the hole for feeding the fire, with other bars and plates for the hollow parts of the furnace, muſt likewiſe be prepared, according to the directions above given. After which, the particular manner of conſtructing the whole muſt be as follows.

The dimenſions of the furnace muſt be firſt ſettled, by this method; which will ſerve alſo for obtaining thoſe of any other kind of furnace

nace designed to be built, where the object to be heated is of a constant or fixed nature. The diameter of the sand-pot, intended to be used, being first taken, six inches must be added to it, for the cavity round the pot, and the length of two bricks, to allow for the thickness of the sides of the furnace. These, being put together, give the diameter of the whole furnace. To find the due height, the height of the pot must be first taken; to which must be added eight inches, for the distance betwixt the pot and surface of the fire when highest, six inches, for the depth of the fireplace, and eight inches, for the distance of the bars from the ground of the ash-hole, with the height of a brick, for a course that must be carried round the edge of the pot, which, being all put together, give the height of the whole furnace from the foundation.

A round cavity must then be made, in the ground, on the place where the furnace is to be erected. This must be large enough, to admit the laying the foundation of the furnace in it; and about eight inches deep; that the bars of the fireplace may lie on a level with the ground; the ash-hole being below it.

The reason, for making this part of the furnace below the ground, is, to prevent the other parts from rising too high; which is a great inconvenience to the operator, with respect to the sand-pot, when he has occasion to put a charged retort into the pot; in doing which, he greatly loses his command of it, if the pot be placed high;

and alſo with regard to the ſand-bath; which, being of courſe conſiderably higher than the ſand-pot, requires, in this caſe, that the operator ſhould have ſomething to ſtand upon, in order to manage the full retorts put into it: an expedient to be avoided wherever it may.

The ground plan or foundation of the furnace muſt be laid in this hole, of dimenſions ſuitable to the diameter, as computed by the rules above given; and carried up of ſolid brickwork of a cylindrical form. But an area muſt be left for the aſh-hole; which muſt be proportioned by laying the bars, fixed in their proper ſituation by means of the croſsbars above directed, on the ground, in the center of the cylinder; and drawing two lines, begun at the furtheſt croſsbar, and continued, parallel to the two outermoſt bars, at the diſtance of a quarter of an inch from them, to the front of the cylinder. The ſpace, ſo deſcribed, muſt be left hollow; the brickwork being carried up on the three ſides of it. This may be done with common bricks and coal-aſh mortar: but they muſt be laid ſolid, that the whole maſs may not ſhrink, when the mortar ſhall be ſubjected to a great heat. The cylinder of brickwork being thus raiſed about eight inches high, the bars of the fireplace muſt be laid over the innermoſt part of the vacuity left for the aſh-hole; and the door, with its frame, muſt be alſo placed in the front of the bars; (though they will not be, in this manner of conſtruction, on a level with the exterior ſurface or front

of

of the furnace;) and the brickwork muſt be again carried up ſix inches, in the ſame manner as before: only it muſt be made to take proper hold, both of the croſsbars of the fire-place, and frame of the door. But the courſes next the fire muſt be of Windſor brick, and laid with Windſor loom, or Sturbridge clay; and, if the heat be intended to be very violent, the joints next the fire ſhould be pointed with the fire lute hereafter mentioned.

When the fabrick is raiſed to this height, an iron plate of a ſufficient ſtrength, or two broad bars, ſhould be laid over the void part, or opening, leading to the door and aſh-hole; that the brickwork may be carried intirely round above: and the cylinder muſt be continued as before; only the cavity muſt be made ſloping from the upper part of the area deſigned for the fire-place, and inlarged in ſuch manner; that, in raiſing the furnace eight inches higher, the diameter of the cavity ſhall be ſix inches more than the diameter of the ſand-pot: which ſix inches is to allow for the three inches diſtance betwixt the pot and the ſides of the furnace, that will here begin to be parallel. The frame for forming the hole, for feeding the fire as before deſcribed, ſhould be fixed in the laſt courſe of bricks, which make this ſlope: the moſt convenient ſituation for which is; the front of the furnace, directly over the opening for the door and aſh-hole.

From this height, a cylinder muſt be carried up, parallel to the ſides of the ſand-pot at

three inches diſtance, till within ſomething leſs than a third of the top of the ſand-pot; ſuppoſing the bottom to be on a level with the foot of this cylinder: and then the hollow muſt ſlope gradually inwards, till it be no wider than juſt to ſuffer the ſand-pot to be let down into it.

In the brickwork of this upper ſlope, muſt be left a cavity, for conveying the ſmoke and flame under the plate of the ſand-bath. It muſt be in the center of that part, where the fabrick of the ſand-bath joins the furnace; and ſhould be four inches and a half, or five inches, in length; and about two inches in height.

The whole of this part of the furnace may be common brick; but the mortar ſhould be of Windſor loom. On the top of the brickwork, raiſed to this ſtate, muſt be laid the iron ring or rim (before mentioned), deſigned to hold the ſand-pot: it ſhould be laid in with fire lute, and well pointed, with the ſame, at the joint it makes with the bricks within the hollow of the furnace. A proper plate ſhould alſo be laid over the cavity, left for carrying the ſmoke and flame under the ſand-bath.

When theſe parts of the furnace are ſo dried, as to hold well together, the pot ſhould be let down into the ring; where it muſt hang by its margin or turned edge; and another courſe of bricks muſt then be raiſed, in a continued line with the ſides of the ſand-pot; that part of them, which touches the pot, being laid in fire lute; and the other parts in coal-aſh mortar.

In this courſe a ſlope muſt be made, on the ſide oppoſite to the ſand-bath, or front, which ever ſhall appear moſt convenient, for the neck of the retorts to bend ſufficiently downwards when placed in the pot. The whole of the furnace which relates to the ſand-pot being ſo completed, the ſand-bath muſt be thus added.

A ground plan or foundation muſt firſt be laid; which need not, in this caſe, be ſunk below the level of the flooring of the place: it muſt be proportioned according to the ſize of the plate intended to be uſed. The length muſt be that of the plate, with the addition of the breadth of two bricks: the breadth muſt be that of the plate, and the length of two bricks. It muſt be formed by building, as it were, four walls, that mark out this proportion; the area within them being, for the preſent, left hollow. This may be done with common bricks, and common mortar: only great care ſhould be taken, the bricks may reſt every where on each other, ſo that there may be no ſettling when the work ſhall be dry.

In adjuſting the ſite of the area marked out for this foundation, it muſt be obſerved, to take, about three inches depth of the ſide of the furnace round the ſand-pot, into the end of the area next it. This projection, of the one part of the furnace into the other, is neceſſary, in order to the bringing the end of the plate cloſe to the flew, that is to convey the flame and ſmoke into the cavity under it, without being obliged to lengthen the paſſage; which

muſt otherwiſe be the caſe; if the whole ſquare of the brickwork of the ſand-bath was built, in a diſtinct area, on the outſide the round building for the ſand-pot.

The four walls, as above directed, may be carried up; till they riſe, within the thickneſs of a brick, to the level of the lower part of the flew for conveying the ſmoke and flame: and the hollow, formed by this ſquare of walls, may be then filled up with broken, or whole, bricks, laid firmly on each other; the joints or interſtices, betwixt them, being alſo filled up with dry aſhes.

A flooring of bricks ſhould then be made over this ſquare body: they muſt be laid in coal-aſh mortar on the under ſide; and the joints on the upper ſide pointed with Windſor loom.

On this flooring, another area muſt be formed by laying rows of bricks at ſuch diſtance, that the plate may reſt on them one inch on each ſide. They muſt be laid croſsways to each other, and for the ends next the plate Windſor loom ſhould be uſed; and for the other part coal-aſh mortar: the plate muſt be then laid on them, and ſet with fire lute.

The openings at the lower ends, into the cavity under the plate, muſt be likewiſe cloſed up by bricks laid breadthway; the ſame caution being uſed, as before, for the ſides, with reſpect to the kind of mortar: but the opening of the flew, for conveying the ſmoke and flame under the plate, muſt be preſerved; as likewiſe another opening at the other end for the paſſage

paſſage of the ſmoke into the chimney; over which opening, a plate, or two broad bars, muſt be laid, to ſupport the brickwork of the ſide over it.

A courſe of bricks, laid breadthways, muſt then be raiſed, cloſe to the edge of the plate, intirely round it: the joints, where they meet the plate, being made good with fire lute; but the reſt with coal-aſh mortar: and, over this courſe, as many others may be laid (but with coal-aſh mortar only), as will raiſe the ſides of the bath to a due height; which muſt be regulated by the ſize of the retorts to be uſed in it.

A chimney muſt then be built, from the ground, cloſe to the vent or flew for carrying off the ſmoke: or, if there be any other chimney within reach, a longer flew may be made, for the communication of the furnace with it; and the erecting a new chimney avoided.

When the whole is of a proper dryneſs, the part of the furnace, belonging to the ſand-bath; may be plaſtered over with good lime mortar: but the dung of horſes, which have eaten hay, ſhould be mixed with it inſtead of hair, which is apt to burn in the heat it is liable to ſuſtain here. The ſand-bath muſt be alſo plaſtered: but mortar with hair is better for that purpoſe; as, not being ſubject there to burn, it will hold the ſides of the bath firmer together than any other kind.

It has been a practice, to put ſacking over the plaſtering of this ſort of furnaces, as well

as thoſe belonging to the houſhold coppers, in order to prevent the effects of a falſe draught through any cracks, the heat may produce in the ſides of the furnace. But it is very injudicious. For, in furnaces of this kind, the ſacking never fails to burn; and ſoon occaſions all the plaſtering to fall to pieces; and bring away with it the mortar; and even, in the caſe of coppers, it burns near the door of the fire-place, and frequently looſens the whole ſheet of plaſter round the furnace.

If this kind of furnace be completed, according to the directions here given, and gradually dried, it will continue in order, if carefully uſed, for a long time: and when the ſand-pot, which will be the firſt part of it, that will fail, ſhall become unfit for further ſervice, the courſe of bricks above it being removed, it may be taken out of the ring; and the fire-place, and other parts of the cavity, being repaired, and well pointed, a new one may be put in its place; and the courſe of bricks above it reſtored: and this may perhaps be repeated a third time, before there be occaſion, to take down any other part of the furnace.

*Of the furnace for the ſublimation of calomel.*

This operation being, now, moſt generally, and indeed beſt, performed in mattraſſes or rounds of glaſs, with ſhort narrow necks, the ſand-pot ſubſervient to it muſt be proportionably ſhallow; and the depth of the furnace correſpon-

reſpondent; which renders it not commodiouſly practicable in the common ſand-pots; whoſe dimenſions are ſuited to retorts and oblong bodies or cucurbits. On which account, therefore, a peculiar furnace, properly adapted to this intention, is neceſſary; as the ſublimation of calomel is one of the moſt material, and not the leaſt profitable, proceſſes of the chemical pharmacy.

The conſtruction above given, for the furnace of the common ſand-pots, will ſerve equally well for this purpoſe likewiſe: allowing for the different ſize of this kind of ſand-pot; which muſt be regulated by the magnitude of the mattraſſes to be uſed in it. The depth of the pot ſhould be two inches more than two thirds of the diameter of the mattraſſes. For they muſt be placed two inches above the bottom of the pot; and immerſed about two thirds of their diameter in the ſand. The breadth ſhould be five inches more than the whole diameter of the mattraſſes; as every part of them ſhould ſtand two inches and a half from the ſides of the pot. The area of the fire-place need not be more than a ſquare of ſix inches: and the courſe of bricks above the pot muſt be wholly omitted: nor is there any occaſion, to have the lower part of the ſurface ſunk below the level of the ground of the place; as is required in the former kind. In all other reſpects, the proceedings, for the erecting this, may be the ſame, as has been before directed for the other.

Of

*Of the furnace for calcination, commonly called the wind-furnace.*

This furnace being principally deſigned for operations on metals; as the deflagration of the crocus antimonij of the college, the antihecticon Poterij, and ſuch others, it need not be bigger than to contain a pretty large crucible; which a fireplace, whoſe area is about eight inches ſquare, will very well allow.

The beſt manner of erecting this kind of furnace is as follows.

Firſt prepare a ſet of bars, of the proper dimenſions, according to the directions above given; as alſo a ſtrong iron door, with its frame, of about eight inches ſquare: with a plate, or two flat bars of a proper ſize to ſupport the brickwork over the aſh-hole; and another ſtrong one, for the ſame uſe, over the door.

A foundation or pedeſtal of bricks muſt then be raiſed, about three feet and a half high, and two feet ſquare; which may be done with common bricks and mortar; and need only, indeed, be four walls; the hollow, formed by which, may be filled up with rubbiſh, and floored over with bricks or tiles.

On this pedeſtal, raiſe three other walls; one on each ſide, and one at the farthermoſt end, of the whole brick thickneſs; forming an area, betwixt them, of the length of ſixteen inches, and of the breadth of eight; of which

which area, the front will be open from the default of the fourth wall.

Over this opening in the front, lay the bars, in the center of the brickwork; and place along with them a plate, that will reach from their edge to the front of the fabric, to bear the brickwork which muſt lie over that part of the hollow. Then carry up the ſides as before, but with four walls inſtead of three, to incloſe the area of the fireplace completely with brickwork: taking care, that the firſt courſe have good hold of the flat ends of the croſs-bars.

This part muſt riſe ſix inches above the bars, and then the door and frame muſt be fixed; and the other three ſides carried up as before.

When the building is raiſed to the height of the door and frame, the ſtrong plate muſt be laid, to bear the brickwork over it; and the brickwork muſt be then gradually made to converge, till it become a chimney, of which the hollow is ſix inches ſquare: or it may be turned into a funnel or flew, to communicate with the chimney of another furnace, if any be ſufficiently near. But, as the wind-furnace demands a very conſiderable draught, if the flew from it be made into the chimney, belonging to any other furnace, which may not happen to be at work when there is occaſion to uſe this, care muſt be taken to ſtop the vent of ſuch furnace into the chimney, to prevent the falſe draught; which will otherwiſe intirely deſtroy its effects on the wind-

furnace,

furnace. This caution ought, indeed, to be always carefully obſerved, where one chimney ſerves for the uſe of two or more furnaces: otherwiſe much time and trouble may be thrown away, by the fire proving very unequal to the occaſion.

The whole of the wind-furnace, from the bars to the top of the door, ſhould be built of Windſor bricks, laid in Windſor loom, and pointed on the inſide with fire lute.

### *Of retorts and receivers.*

Theſe are the moſt employed of any glaſs utenſils, in the practice of modern pharmacy: having almoſt ſuperſeded the uſe of all others. Formerly cucurbits, with glaſs heads were choſen for many operations; and allodials were in ſome caſes added: but large retorts, with proportionable receivers, will better anſwer almoſt all the ſame ends.

The common form of retorts is not faulty; provided two kinds of them be had: the one ſhort and thick, with very long and large necks; and the other taller, with ſhort necks. The particular uſe of each of theſe kinds, will be pointed out, in ſpeaking of the ſeveral operations, to which they are intended to be ſubſervient. But it will be found very advantageous, to have a ſtock of both ſorts ready for all occaſions; and to be prepared to render the necks ſhorter, and enlarge their orifices, according to the deſigned uſe. This muſt be done

done by iron rings; whoſe diameter muſt be correſpondent to the intended thickneſs of the end of the neck. If the ring be applied to the part where the ſeparation is to be made, and this heated part be touched with any moiſture, the piece behind where the ring has been placed will immediately fall off.

It is uſual to have this done at the glaſs-houſe, before the retorts are ſent from thence; but every good operator ſhould ſee it performed himſelf, in the manner ſuitable to the uſe, the retort is to be applied to. For on the adapting properly, the ſize, and form, of the retort, to the nature of the operation, the ſucceſs in many caſes depends in a greater degree, than can be imagined by thoſe, who have not had occaſion to make accurate experiments of this kind.

Receivers ſhould be alſo always had, both with ſhort, and long, necks: it is proper indeed to have them much larger, for moſt purpoſes, than what are generally uſed. A greater quantity of condenſing ſurface rendering the operation both more profitable and ſafe; as it prevents the forcing of the lute, and the eſcape of the vapour; as well as the hazard of burſting the veſſels, on the raiſing the fire too high; if the luted juncture ſhould hold good againſt the force of the expanded vapour; or the necks of the retort and receiver ſhould fit ſo exactly as to admit no paſſage for it.

*Of cucurbits or glaſs bodies for ſublimation.*

Though the moſt general uſe of retorts has greatly excluded that of this kind of veſſel; yet there are ſome proceſſes, which require, that they ſhould be retained; as in the inſtance of mercury ſublimate, cinnabar of antimony, ens veneris, and others. The common form is good; but ſhould be varied into two kinds, the one thick and ſpheroidal, or of a true oval form; the other long and greatly tapering. The different uſe of each kind will be ſhewn, in treating of the reſpective operations, where they are to be uſed. A ſort, with the bottom almoſt flat, of a ſmall height proportionable to the breadth, and tapering ſo as to form a narrow neck at the top, ſhould be alſo had, where camphire is to be purified.

*Of tritoriums, or ſeparating funnels.*

The common figure and ſize of theſe veſſels will anſwer the purpoſe, where only ſmall quantities of the fluids to be ſeparated are in queſtion: but where diſpatch is wanted, and the quantity large, they fail to perform what is wanted, in any efficacious manner. The greateſt occaſion for this kind of inſtrument to be rendered effectual, as to conſiderable quantities of fluids, is with reſpect to the ſeparating the oil from the ſpirit of hartſhorn; as well after the firſt diſtillation from the materials, as the

the ſubſequent rectifications. It is there beſt done by very large glaſs funnels; and a tin or pewter veſſel, whoſe ſtructure we ſhall here deſcribe; but refer, both for the uſe of it, and the funnels, to the proceſs for preparing this medicine.

The tin or pewter veſſel may be of a cylindrical ſhape, of a foot diameter, and four or five feet in length. It muſt be made entire, both at the top and bottom: but muſt have a ſhort tube, at the top, for receiving a large tin funnel, by means of which, it may be filled; and two other ſmaller tubes, in the body; the one of which muſt be about a foot from the top; and of the thickneſs of the little finger: the other muſt be about ſix inches from the bottom; and of the thickneſs of a ſwan's quill. Theſe laſt tubes, may be about three inches long; and muſt have wooden ſtoppers wound about with linnen, or thread, to make them fit; but the firſt tube need not be more than inch long; and may be ſtopped with a cork.

## *Of filters.*

The flannel bags, employed for this purpoſe, do the office very well, where no greater purification is required, than the ſtraining thro' flannel can effect: but, where a greater clearneſs is neceſſary, paper may be uſed. The ſmall glaſs funnels, generally applied to this end, are neither capable, with reſpect to diſpatch or quantity, of anſwering well their purpoſe:

poſe : for which reaſon, this operation is frequently omitted, where the quantity of fluid is great, in caſes, where it might be practiſed with great advantage and convenience, were better methods underſtood. The kind of filters, I would recommend, intirely remove all difficulties in the practice of this neceſſary means of purification; and may be applied, as well to the greateſt, as the ſmalleſt quantities. It is an earthen cullender made of a ſize proportionate to the buſineſs intended to be performed by it; and fuller of holes, which ought to be alſo of a larger bore, than in the ſort intended for houſhold purpoſes. The cullender of the largeſt ſize muſt not however exceed, what a ſheet of filtering paper will well cover : for any greater magnitude than that would become uſeleſs. With theſe, muſt be had, alſo, a glaſs funnel, whoſe mouth is broader than the cullender; and a ſtand of wood, by which the cullender may be ſupported over the funnel. Where this kind of filter is not uſed, in the intention of purifying any liquid body, but for ſeparating a ſediment or precipitated powder from ſome ſuperfluous fluid, a linnen cloth, of the ſize of the paper, muſt be alſo procured.

By this apparatus, all the ends of filtering may be anſwered with great eaſe and expedition. Very large glaſs funnels will next ſuit this purpoſe beſt; provided the paper be ſupported, in the hollow of the funnel, with a little cotton lightly thruſt into

into the hollow: but this method is much more precarious, as well as ſlower, than the other: the paper, if not good, or uſed with fluids of a relaxing quality, being very ſubject to break during the operation; which fruſtrates the whole already done.

### *Of veſſels for the chryſtallization of ſalts.*

Very large glaſs receivers, containing eight or ten gallons, ſhould be provided, and fixed in ſtraw, in baſkets, ſo firmly, by means of ſticks or cords paſſed through their ſides, that the glaſs and baſket may be reverſed together. Large earthen cullenders ſhould be likewiſe procured with narrow bottoms for receiving the ſalts when taken out. This apparatus will very well ſerve the purpoſe, for common elaboratories: but, where the chryſtallizing glaubers, or other ſalts is made a particular manufacture, the following will diſpatch very great quantities, with much leſs trouble.

A leaden boiler muſt be placed over a very gentle furnace; at a due diſtance, from this, muſt be placed a leaden ciſtern; for the formation of the chryſtals, proper ſized baſkets muſt be provided, to place over this ciſtern, by means of a frame laid croſs it, for receiving the chryſtals when taken out of the ciſtern. A large flat frame of baſket-work, with a rim of the ſame, round the edge, riſing two or three inches, to prevent the ſalts from falling off, muſt likewiſe be made, for drying the ſalts.

For the chryſtallizing tartar, or making cremor tartaris, the following apparatus may be uſed, with great advantage. A large leaden boiler muſt be ſet over a gentle furnace; to this muſt be joined two cylinders of lead, by means of two pipes, which muſt have a ſtop-cock to cut off the communication when neceſſary.

*Of the apparatus for levigating teſtaceous, and other hard, bodies, where the quantity to be prepared is great.*

The common implements uſed for this purpoſe, (viz.) the mortar, and levigating-ſtone and muller, are very well adapted to the end. But ſince the late attempts, made by particular perſons, to gain advantages by the preparation of the medicines of great conſumption, at very low rates, by more expedite means, a method has been practiſed of performing this operation, with much leſs labour, and conſequently greater profit, than by the uſual way.

This has been done by the introduction of the horſe-mill and roller; which have been applied to this purpoſe, in the ſame manner, as it was before by the ſugar refiners, and manufacturers of ſnuff; and at the ſame time that the machine grinds the materials, it alſo works the ſieves for ſearcing the powder.

Thoſe, who would diſpatch large quantities, will find great ſavings in the uſe of this method: but I think it needleſs to give a deſcription, here, of the conſtruction of ſuch

a mill; as they, who make it their proper buſineſs to erect them, and muſt of courſe be employed for that purpoſe, do not want directions for the manner of making that part, which properly belongs to the mill, in the uſual way: and will eaſily find out an expedient manner of adding the parts requiſite for working the ſieves, when they are informed of the uſe of them.

*An improved apparatus, for the more commodious and advantageous diſtillation of volatile ſpirits from hartſhorn, bones, or any other proper animal ſubſtance, by the uſe of a worm as a refrigeratory.*

A large iron-pot muſt be firſt provided of the following form. The body of the pot muſt be of a cylindrical figure, with a concave bottom: and converging at the top, ſo as to make a kind of wide conical neck. Into this neck, muſt be inſerted a tubulous arm; which is to ſerve, inſtead of the head uſed in common ſtills, to convey the vapour into the worm or refrigeratory. The height, from the bottom of the pot to the beginning of the converging part or neck, may be four feet; and the diameter two and a half. The length of the converging part or neck may be two feet; and the diameter of it, at its joining with the pot, at the top or mouth of it one foot. The length of the arm may be one foot eight inches; and the diameter of it, at its joining with the pot, four inches; and diminiſhing, gra-

dually, to two inches and a half, at the other end. This arm muſt ſlope downwards, in ſuch manner, that any fluid, which ſhall be condenſed in it, will run out at the end: that is to ſay, the axis of the cone, formed by this arm, muſt decline two inches from the horizontal plane. The edge of the pot, at the top of the neck, muſt be dilated, and turned outwards: and a groove muſt be made in it, to receive a flat cover of lead. In the body of the pot, muſt be inſerted, three tronions, of about ſix inches length: they muſt be ſtrong enough to bear the weight of the pot, when it is hung in the brickwork by their means. They ſhould be placed, at equal diſtances, a little below that part of the cylindrical body where the neck begins to form itſelf. The groove, in the neck, ſhould be filled with a ſolid piece of lead exactly fitted and cemented to it: in this, another groove muſt be cut, to receive a leaden cover adapted to it, ſo as not to make a perfectly cloſe joint; which may be eaſily done, by beating the cover, after it is placed in the groove, till it fit in every part. The cover muſt be made of lead, about a quarter of an inch in thickneſs; and a bow handle muſt be fixed in the middle of it.

A door and frame, bars for the fireplace, frame and ſtopper for the hole for feeding the fire, &c. muſt be provided, in the ſame manner as for the furnace for the ſand-pot.

The foundation of the furnace muſt be alſo laid as for that of the ſand-pot: only it ſhould not

not be ſunk, as in that caſe, below the level of the ground. For the bars of the fireplace may well be admitted to be eight or nine inches above it, without danger of raiſing the other parts of the fabric too high.

The dimenſions of the ground plan muſt be thus ſettled. Take the diameter of the pot; and add to it ſix inches, and the length of two bricks.

The proceedings in the reſt of the parts muſt be the ſame, as were before directed for the ſand-pot: the ſame proportion alſo being obſerved betwixt the bottom of the pot, and ſurface of the fire: and likewiſe between the ſides of it, and thoſe of the furnace. The pot muſt, however, after the fireplace, and ſlope above it, are built, be fixed in its intended ſituation, with the help of props, by which it muſt be there ſupported, till the ſides of the furnace be raiſed high enough, to take the tronions, and bear the pot. The furnace may be carried up round the pot, in a parallel form to it, at the diſtance of three inches: for, as the pot is hung by means of the tronions, there is no occaſion for any ſlope, at the extremity of the brickwork, to make it ſupport the pot; but the cavity may be cloſed in, by bricks laid croſs, from the ſide of the furnace to the pot, juſt above where the cylinder ends. Theſe bricks ſhould be ſet, where they touch the pot, with good fire-lute; and ſo ſloped at their end, as to ſuit the figure of the pot; and lie as cloſe to it as poſſible.

A hole muſt be left in the ſide, juſt under the bricks that cloſe in the cavity, for the communication with the chimney, which muſt be managed, as in the former furnace; as muſt likewiſe the plaſtering, &c.

A worm, and proper tub, muſt be then prepared, of the ſame form with thoſe commonly uſed; but differing greatly in dimenſions. For the pipe ſhould be two inches and a half in diameter, and twelve feet in length. At its exit from the tub, a ſmaller pipe, of about three quarters of an inch in diameter, muſt be joined to it, in ſuch manner, that the bore of this ſmall tube, may be in the depending part of the bore of the large one, that the paſſage may not be obſtructed by the joint. This leſſer pipe ſhould be about a foot long; and muſt be ſo turned downwards, that it may go into the neck of the receiver; or, at other times, have its orifice ſtopped by a cork. In the higheſt part of the worm, within the tub, muſt be likewiſe inſerted another ſhort pipe, of half an inch diameter, and ſix inches length; in order to receive a funnel, for filling the worm occaſionally with water: this pipe may have a leaden ſtopper fitted to it; as it muſt be always cloſed, when there is no neceſſity to uſe it. The upper end of the large pipe, which forms the worm, muſt paſs through the ſides of the tub, as well as the lower; and muſt be joined to the arm of the pot, by means of ſheet lead; which muſt embrace the arm, and the ſides being properly ſloped and ſoldered together,

ther, it must be brought to form a pipe, of nearly the same bore with that of the worm, to which also it must be soldered; care being taken, that the current be preserved here as well as in the other end. The whole of the worm may be of lead, as it is much cheaper than pewter, and it will not be so corroded by the distilled matter as to occasion any inconvenience.

The tub need not be of greater dimensions, than are necessary, to suit the figure of the worm: and to contain about six inches height of water over it.

Two large receivers should be likewise provided, for containing the distilled matter, as it flows from the pipe of the worm. They should be made with narrow necks, to receive the end of the pipe affixed to the worm; as also with a flattish bottom, and strong, in the bottle fashion, as they will stand with their necks upwards. The reason for directing duplicates of them is, that the one may be ready to be put to the worm, when the other is taken away to be emptied; as they will be several times filled during one operation.

A tin pipe, of about half an inch diameter, and of sufficient length to pass, from the neck of the receiver, to the ash-hole of the furnace, must also be provided. To the end of this pipe, another piece of the same bore, about three inches in length, must be soldered, at an angle something greater than a right one; being first reduced to a flattish form, except where it joins to the long pipe, so that, when the long pipe

is laid from the aſh-hole into the receiver, this may go into the neck of it, along with the end of the pipe fixed to the worm; and the remaining part of the orifice of the neck of the receiver, being luted with ſtiff clay, may convey, any fumes or vapour, which may remain uncondenſed in the receiver, under the bars of the fire: through which being carried by the draught of air, the elaboratory will conſequently be freed, in a great degree, from the powerful and offenſive ſmell which attends this operation.

A kind of iron ladle, with a wooden handle, that will reach to the bottom of the iron pot, and to which the ladle ſhould be fixed almoſt horizontally, muſt be made; for emptying the pot of the remaining part of the matter after the diſtillation. The ſize of this muſt be determined by the neck of the pot; to which it muſt be ſo proportioned, as to paſs in and out freely.

A funnel of tin muſt be alſo provided, to fill the worm with water, whenever there ſhall be occaſion.

*A pewter alembic, for the diſtillation of the volatile ſpirit of ſal ammoniacum, and the ſpiritus volatilis aromaticus.*

This alembic muſt be made of good pewter: its body may be either of a cylindrical figure, or a long ſquare, ſuited to the form of the ſand-bath where it is to be uſed; its neck ſhould

ſhould be about ſix inches high, and five in diameter, with a proper groove, to admit a cover to be put into it, ſo as to make a cloſe joint with as little lute as poſſible. From this neck, muſt go two hollow arms, like that of the hartſhorn pot before mentioned. They may be of the diameter of two inches, and about eighteen inches long, or as may be moſt convenient, to admit a receiver to be fixed to them, according to the ſituation where they are to be uſed. They muſt ſlope downwards, in ſuch manner, that the fluid, which is collected, in them, from the vapour, may flow into the receiver. If the ſand-bath, or pot, where they are to be uſed, ſtand clear of any wall, the arms may be fixed oppoſite to each other: but if the ſand-bath be placed againſt a wall, ſo that receivers can be put on one ſide only, the arms may be both on that ſide of the alembic; but fixed to form ſuch an angle, as may give room for the receivers to be put to them: and their length muſt be ſo proportioned, as to free the receivers from the ſide of the ſand-bath.

Receivers muſt alſo be made, with necks ſuited to theſe arms: and they ſhould be procured of as large a ſize as they can be made, preſerving a proper ſtrength.

## *Of the apparatus, for the diſtillation of the oil of turpentine.*

The form of the furnace, and iron pot, above deſcribed, for the diſtillation of the ſpirit of

of hartſhorn, will equally well ſerve for this purpoſe: but the cover of the pot ſhould have a ſhort tube in it, by which the pot may be occaſionally ſupplied with water, during the diſtillation: and this tube ſhould have a leaden ſtopper fitted to it, by which it may be cloſed at all other times. The pipe of the worm, provided for this purpoſe, need not, however, be of the wideneſs neceſſary for volatile ſpirits; but may be of the common form, and dimenſions, uſed in other caſes. Beſides a ladle of the ſame kind with that directed, for taking out the remaining materials after diſtillation of volatile ſpirits, another inſtrument muſt be had, for cutting, or dividing, the remaining colophony, whether roſin, or pitch, after the diſtillation of the ſpirit of turpentine, in order to its being ſo divided, as to paſs the narrow part of the neck: it muſt be formed of a flat piece of iron, half round, with a moderately ſharp edge, fixed into a wooden handle, of a due length, with the round end downwards: the breadth of the iron, and the length of the handle, may be regulated, by the wideneſs of the neck, and the depth of the pot.

*An alembic for the diſtillation of quickſilver.*

The common inſtruments, directed in the books of chemiſtry, or uſed in the elaboratories for the preparation of medicine, for the performing this operation, are very defective: being

ing either retorts, or other glaſs veſſels, which are very liable to break, as well as the receivers uſed with them as refrigeratories: but the refiners, and others, who have more frequent occaſions to re-purify mercury, have introduced an inſtrument, which anſwers this end with very little trouble or hazard. It is a kind of deepiſh pan of iron, with a cover, of the ſame metal, or copper, ſoldered on to it; in which cover muſt be a ſhort tube, for the pouring in the mercury, and taking out the recrement, or caput mortuum, if there ſhold be any.

This tube muſt have a ſtopper, capable of being ſo ſcrewed into it, as to render the joint, impervious to the vapour of the quickſilver. Into this pan, at the upper part of one ſide, muſt be ſoldered, likewiſe, a gun barrel, ſtoping downwards, in order to condenſe the vapour of the quickſilver when it riſes into it. The end of this barrel muſt be ſo bent downwards, that, when the pan is placed on a common fire, it may be immerſed in a veſſel of water placed properly for that purpoſe.

*An alembic for the diſtillation of vinegar.*

This alembic ſhould be made of the ſame ſubſtance as the ſtone-ware manufactured at Vaux-Hall. It may be round, or made, both in figure and magnitude, as may beſt ſuit the form of the ſand-bath, where it is to be uſed. The neck muſt be ſhort, and wide enough to admit the lower part of the head to paſs into it.

it. It must have a head, made of the same substance as the body, and formed as the heads, made of the same earth, used for the pots, intended for the distillation of aqua fortis: except as to the size, which in this case should be no more than is necessary, to admit of two arms proper being joined to it. These arms must be of two inches diameter, at the extremity; but larger where they join the pot. Their length, and manner of being set on the head, must be regulated, by the place where the alembic is to be used, according to the directions before given, with respect to the alembic for the distillation of volatile spirits.

The receivers should be moderately large: and their necks suited to the arms of the alembic head; to which they are to be joined.

## *Apparatus, for the making oil of vitriol from sulphur.*

The principal utensils, in this work, are glass globes; which must be made as large as possible, and, according to the late improvement in the blowing them, may be of very great magnitude. The globes, having their necks cut, by a proper ring, to a due wideness, which must be regulated by the magnitude of the stopper below described, must be fixed in a proper frame, with their necks pointing horizontally: but they must be so hung, in this frame, that, on occasion, they may be so turned,

turned, as to diſcharge any fluid, they contain, through their neck.

The frame for ſupporting the globes may be of a ſquare figure, made of wood, and of a moderate ſtrength. The bottom muſt be open, ſo that ſo much of the globe may paſs through, to reſt upon the ſand, as may be neceſſary to heat a gallon of water contained in it. This bottom muſt be fixed, with hinges, on the front ſide, and reſt looſe on the oppoſite, on a proper ſupport made in the frame; ſo that, by means of this conſtruction, the back part of the globe may be raiſed, by lifting up the back part of the bottom; and the neck made to decline ſo low, that any fluid contents may run out.

Spoon ſtoppers muſt be fitted to theſe necks, made of the ſame red earth, which is uſed for long necks. The part, that goes into the body of the globe, may be five inches long, and two and a half broad, in the form of a long deep ſpoon. The part, which makes the joint of the neck, muſt be round, and of a diameter ſomething greater than the breadth of the ſpoon part; ſo that, when the ſpoon part is introduced within the cavity of the globe, this part may fill up the orifice of the neck, and prevent any eſcape of vapour through it.

Furnaces, with ſand-pots, muſt be likewiſe provided, for the dephlegmating the oil, after it is obtained in the globes. They may be conſtructed in the manner before directed

for

for ſand-pots p. 16. and a ſhallow ſand-bath muſt be likewiſe built, which may be made alſo according to the directions given before: except, that the ſides of the bath need not be raiſed more than ſix inches: becauſe the globes are only to reſt upon the ſand.

A furnace, with a ſand-pot, may be placed at each end of the ſand-bath: and a flew, in that caſe, may paſs to the chimney, from about the middle: or, if the ſand-bath can be made very long, more furnaces, with pots, may be conjoined to it, at the ſide; ſo as to ſupply the heat wanted. In large works, the adjuſting the furnaces properly to the number of globes, which are required to be heated, is a point of great conſequence; but cannot be regulated otherwiſe than by occaſional diſcretion.

Retorts muſt alſo be provided, for the dephlegmation. They ſhould have large round bodies, with as low necks as poſſible: and the ſand-pots ſhould be adapted to their figure, by their being proportionably ſhallow, and wide. The receivers ſhould be of moderate magnitude; but blown ſtrong, to prevent the accidents, which are liable to happen, on taking them away from the retorts and emptying them of their contents.

In the greateſt work, which has been hitherto erected, the powdering the materials was performed with mortars and peſtles: but it would be much more advantageous, in any large work, to employ a horſe-mill, with a rolling-

rolling-ſtone, ſuch as is uſed by the ſugar bakers, &c.

*Apparatus for the diſtillation of aqua-fortis.*

A large iron cylindrical pot muſt be firſt provided. It may be three feet, or more, in height, and two feet in diameter. It muſt have a proper rim, at the top, with a groove, to receive the head, and admit of a due thickneſs of lute's lying alſo in the groove round it. The common figure and proportion of pots, of this kind, now made, is faulty; they being of a conical form; by which means, their contents in the part moſt expoſed to the heat, are leſſened, without any advantage to compenſate for it: and they are alſo made too broad, in proportion to their height, from whence a conſiderable part of the effect of the fire is loſt.

For this pot, a head, with two arms, muſt be procured; of the form, in which they are at preſent made for this purpoſe: the dimenſions muſt be regulated by thoſe of the pot, as it muſt be adapted in the making, by means of a proper meaſure given to the workman, ſo to the ſize of the pot, that it may lie within the groove; leaving room for lute to be put round it.

Receivers muſt be alſo provided, with necks proportioned to the arms of the head, which they are to receive: they ſhould be procured of the largeſt ſize, and greateſt ſtrength poſſible.

*Improved*

*Improved apparatus, for making the ſpirit of ſulphur by the bell.*

A large retort muſt be firſt provided: in whoſe bottom, a large hole muſt be made: a glaſs mortar muſt be alſo procured, with a concave glaſs plate to cover it; in the middle of which plate, alſo, muſt be a hole; ſo that any fluid, which ſhall fall into it, may run into the mortar. To theſe, muſt be added one of the common glaſſes, made, in form of a ſection of a cone, for drinking water; which is to ſerve as a ſtand for a ſmall earthen diſh, for containing the ſulphur. This diſh muſt be of ſuch magnitude, as not to fill up the hole of the receiver; but, when placed juſt within it, may ſuffer the air to have acceſs, and to paſs, on every ſide, round the ſulphur. To the neck of the retort, which ſhould be long, and cut to a wide orifice, a large receiver muſt be fitted; into which, when blown, muſt be inſerted a large tube, as wide and tall as poſſible; which tube muſt ſtand perpendicularly upwards, when the receiver is fixed to the neck of the retort.

This apparatus will collect much more ſpirit than the bells, commonly uſed; and may be ſo managed, that the fumes may be carried off, by means of the tubulated receiver, in ſuch manner, as to prevent, in a great degree, the annoying the operator, in that diſagreeable,

and

and indeed detrimental manner, which attends the other method.

*An improved form, for a glaſs veſſel, to be uſed for the preparation of the mercurius-calcenatus, or precipitate per ſe.*

The moſt commodious figure of a glaſs, for this purpoſe, is ſuch, as gives the largeſt ſurface to mercury contained in it, admits the air moſt freely, and, at the ſame time, excludes the duſt; which, in this tedious operation, is apt otherwiſe to be collected. In the following theſe ſeveral intentions are perſued.

Let the glaſs be made of a conical form, terminating in a ſtreight neck. The baſe of the cone may be five inches diameter; or leſs, in proportion to the quantity of mercury to be calcined in it. The height, from the baſe to the neck, may be ſeven inches; and that of the neck three. About two inches from the bottom, let there be two ſhort tubes inſerted, bending in a round, ſo that the mouths may be downwards. The top of the neck ſhould be, likewiſe, ſo turned, that the mouth may bend downwards, to prevent its receiving any duſt, or ſoot, that might otherwiſe fall into the glaſs among the mercury.

*Of lutes.*

There are a great variety of lutes in uſe; moſt of which, rightly applied, would anſwer

ſome end; but the art is, rather the adapting each to its proper purpoſe, than the forming the compoſition.

For the making good junctures out of the reach of a burning heat, a mixture of linſeed meal, or wheaten flower, and whiting, in the proportion of one part of the firſt to two of the laſt, tempered with a ſolution of gum ſenegal in water, and ſpread upon the joint, a narrow piece of paper ſmeared with the ſame being put over it, and preſſed cloſe, will be found ſufficient: but even the trouble of this may be greatly ſhortned, where the glaſſes fit each other well, and there is no elaſtic vapour to be confined, by the uſe of a narrow piece of bladder ſmeared with the white of an egg, or a ſtrong ſolution of gum arabic or ſenegal, and fitted to the glaſſes over the joint.

In diſtillations, where the eſcape of part of the vapour is looked upon as a material inconvenience, it may be almoſt wholly prevented, by the uſe of quicklime well powdered, and tempered with linſeed-oil, boiled till it acquire a very brown colour, (or drying oil as it is called by the painters.) But this mixture muſt be immediately made before it be uſed: and if it be employed, great care muſt be taken, to manage the fire, in ſuch manner, that the vapour may not riſe ſo faſt as to heat the refrigeratory, or condenſing veſſels, beyond the due point: for it renders the ſeparate glaſſes, joined together by it, as one intire body; and will

reſiſt the efforts of the rarefied ſteam, to ſo great a degree, that the glaſſes are liable to burſt before it will give way.

The occaſion, where a particular kind of lute is moſt material, and where the moſt errors are practiſed in the choice, is, when the joints to be made good are ſubject to acquire a burning heat, during the operation. For here all ſuch compoſitions, as owe their cohering power to animal or vegetable ſubſtances, are neceſſarily burnt, and reduced to the ſtate of a mere calx. The following compoſition, which, for the ſake of brevity, I call the fire-lute, where I have occaſion to mention it, will, however, extremely well anſwer this end; and may be made with ſmall expence, as the ingredients coſt little, and may be prepared in large quantities ready for their being mixed together when wanted.

Take vitriol calcined to redneſs, and powdered, two parts, the ſcoria or clinkers of a ſmith's furnace finely levigated, and Sturbridge clay, or Windſor loom, dried and powdered, each one part; mix them well together; and then temper them with the blood of any beaſt; a twentieth part of their weight of ſhort hair being beaten up with them. This is, not only an excellent lute, for all junctures of veſſels where they are expoſed to a great heat; but alſo an extremely uſeful cement, for the pointing furnaces, and making good all the joints of any part of them, which are liable to ſuſtain a burning heat. It is likewiſe the beſt

compoſition, for coating the outſides of glaſs bodies, or other ſuch veſſels, as are to be uſed in the naked fire, where great caution againſt their breaking is requiſite; but, in common caſes, the following cheaper mixture may be ſubſtituted.

Take of ſand Windſor loom, or (if good) common loom, and dung of horſes, which feed on hay, each equal parts; temper them with water; and beat them thoroughly together.

The laſt kind of lute, or cement, I ſhall mention, is ſolely, for the repairing the cracks, and replacing the broken pieces, of receivers, or other glaſs veſſels, which admit of being uſed after they are in that condition; and this, judiciouſly applied, in an elaboratory, where many ſuch veſſels are uſed, will make a conſiderable ſaving.

Take an ounce of Suffolk cheeſe, or any other kind devoid of fat; grate it as ſmall as poſſible; put it, together with an ounce of quicklime, finely powdered, into two ounces of milk, from which the cream has been taken away; mix them well, and uſe the mixture immediately; ſpread this upon a narrow piece of linnen rag accommodated to the form of the crack; and it will make the part equally ſtrong, and ſound, with the reſt of the veſſel.

SECTION

## SECTION II.

*General obſervations, on the moſt eaſy and profitable methods of performing ſeveral of the operations of chemiſtry and pharmacy.*

### *Of diſtillation.*

The principal art in diſtillations, of every ſort, conſiſts in the chuſing well the kind of apparatus for each purpoſe; and adapting, the ſeveral parts of it, rightly to each other. By a due ſkill in, and attention to, theſe, many operations, of a precarious nature, may be rendred aſſuredly ſucceſsful; and great ſaving, in time, trouble, fewel, and the produce of the operation, may be made in the moſt eaſy and certain manner.

Spirit of wine, and all the ſpiritous compound waters made of it, ſimple waters, and eſſential, or etherial oils, are beſt managed, in the copper ſtill with a worm, by the uſual methods: except, that the making the fireplace ſo forwards, under the brickwork of the furnace, as is generally done, is a very groſs fault. For it ſhould be always thrown as far towards the center, as the dimenſions of the body of the ſtill will admit, and, though this is limited, in a very large apparatus, yet the fire ſhould be under ſome part of the bottom

of the ſtill, in all caſes; and as much of that expoſed to it, as is conſiſtent with the bearing, it requires to have, on the brickwork. In the caſe of ſmall ſtills, they may be hung free of any brickwork, in the body of the furnace, after the manner directed for the ſand-pots.

The diſtillation of acid ſpirits is beſt performed in retorts, in the ſand-pot. Thoſe, choſen for this purpoſe, ſhould have a large low bulb, and a low long neck; and be placed deep in the pot; that the vapour, which can only be ſuſpended in a great degree of heat, may riſe over the helm; and not circulate in the body of the retort, nor be condenſed in that part of the neck, which is not depending with reſpect to the receiver.

In the diſtillations of ſuch bodies, where two ſubſtances are put into the retort to act on each other by commenſtruating powers, as oil of vitriol, or ſpirit of nitre and mercury, and ſpirit of nitre and ſea-ſalt, care muſt be taken, if a firm lute be uſed, to leave a ſmall vent. For a great quantity of air being generated, in the action of theſe bodies on each other, which, from its not being capable of ſuffering any condenſation, will neceſſarily force a paſſage ſomewhere, if none be left for its eſcape, if the lute reſiſt ſufficiently, it muſt conſequently burſt either the retort or receiver. The ſame caution ſhould be obſerved in other operations, where ſeparations are made of compound bodies, by the medium of others; as alſo in the diſtillation of animal or vegetable ſubſtances,

where

where they are analyzed by a burning heat. In all which caſes, air is copiouſly produced; and will never ſuffer itſelf to be confined. From the want of knowing, or attending to, this circumſtance, many operations are conducted, ſo as to occaſion nuſance and danger to the operator, as well as loſs of the diſtilling matter, which might otherwiſe be rendred ſafe, inoffenſive, and much more profitable. Amber may be alſo beſt diſtilled in retorts in the ſand-pot; but they ought, in this caſe, to have very large long necks, with a wide orifice; as well that the ſalt may all fix in the neck, as that it may be eaſily got out of it. The diſtillation of animal ſubſtances, where the quantity is ſmall, may be alſo performed in the ſame manner.

The diſtillation of a variety of different ſubſtances is beſt performed in retorts, in the ſand-bath, which varying in the degree of heat in the different parts, it is proper to diſtinguiſh the ſeveral kinds of ſubſtances, that may be diſtilled in it, into three orders. In the firſt may be included the rectification of ſpirit of hartſhorn; the production of ſpirit of ſal armoniac, either by means of fixed alkaline ſalt, or lime; the rectification of oil of amber; and the diſtillation of vinegar: for theſe operations, long retorts, with tall and long necks, ſhould be choſen; for the water and crudities, being leſs volatile than the ſubſtance intended to be freed from them, a more perfect ſeparation will be made, if the vapour circulate within the glaſs ſo as to ſuffer the water to be con-

denſed againſt the ſides: except in the caſe of vinegar, where the retort ſhould have a large bulb, and lower neck, as the acid, which is the object of the operation, is leſs volatile than water; and apt to remain in the retorts, even when every advantage is taken.

In the ſecond order may be placed ſal volatilis aromaticus, ſpiritus nitri dulcis, ſpiritus vitrioli dulcis, ſpiritus lavendulæ compoſitus; and ſome others.

In the laſt order may be put highly rectified ſpirit of wine, or alcohol when wanted: or the ſpirit. nitri; or vitriol. dulcis, or ſpir. lavend. compos, may, on occaſion, fill even the cooleſt part without any inconvenience. By obſerving this ſyſtem of management, and always contriving, that every part of the ſand-bath ſhall be employed, whenever the furnace is ſet to work, great ſavings will be made in trouble and fewel: and, though it is not eaſy to adapt the ſeveral operations, thus carried on together, in ſuch manner to each other, that they may be all finiſhed at the ſame time; yet there will no inconvenience ariſe from that, where proper means are uſed. For an expert operator may, without difficulty, change the exhauſted retorts for others, freſh charged, in any part of the furnace, even when it is in the hotteſt ſtate; a practiſe, I can aſſert to be extremely advantageous, and no way hazardous, when due care is taken; though hitherto ſo much neglected, that I never knew it followed except where directed by myſelf.

In

In diſtillations, made in retorts, it is of great conſequence, to have the receivers as large as poſſible; as it renders the operation both much quicker and ſafer, to have a ſufficient quantity of condenſing ſubſtance.

## *Of ſublimation.*

The ſublimation of ſal Ammoniacum, in order to produce the flowers, or the ens veneris, as alſo of the volatile ſalt, when obtained by means of chalk, is beſt performed, in retorts, in the ſand-pot. The retorts ſhould have large bulbs, and low, but very wide necks.

The heat of the ſand-pot is alſo ſufficient, for mercury ſublimate; which may be beſt managed in a very large glaſs body of an oval figure: but this kind of furnace is not to be depended upon with regard to cinnabar, which cannot with certainty of ſucceſs, be treated in any other way than in an earthen, or glaſs body luted, and expoſed naked to the fire. In the rectification of ſalt of amber, ſal cornu cervi, or ſal volatile Ammoniacum, the ſublimation may be beſt performed, in the ſecond ſtage of the ſand-bath, in low retorts, with very ſhort necks, and wide orifices. In the ſublimation of volatile ſalts, great care muſt be taken, that the heat be not too great: and if it cannot be kept under, without delaying too much the concomitant operations, in the ſand-pot and the ſand-bath, the ſand ſhould be removed from the retorts containing the ſubliming matter; and

they

they ſhould be raiſed higher. But a little cloſe obſervation will ſhew the proper depth, in which they ought to be placed in the ſand-bath; and the height of the retort ſhould be regulated accordingly: for if the neck ſtand too high above the ſand, the ſalts will collect in it, and choak it up, inſtead of paſſing into the receiver.

Though large receivers are recommended for diſtillations, yet ſmall ones ſhould be uſed for the ſublimation of ſalts; as the cake formed againſt the top and ſides will otherwiſe want, both that denſity, and thickneſs, which are neceſſary for their keeping well, and their ſalable appearance.

## *Of calcination.*

Calcination is performed on two principles, by calefaction, that is, by the heat communicated by means of exterior fire: and by ignition; that is, where the matter is calcined by the fire generated within itſelf, by means of its own combuſtion; and this is effected either by admiſſion of air to the accended body; or by the admixture of nitre, which when uſed for this purpoſe, occaſioning an explosive appearance, the chemiſts have called the operation, detonation, or deflagration.

Where large quantities are to be calcined by the firſt principle, as in the caſe of hartſhorn, a large furnace like, in form, to that of the potters or tobacco-pipe-makers, ſhould be had;

or

or otherwiſe, where the occaſion is but rare, the matter may be ſent to the furnaces of that kind, and there prepared at a very ſmall expence.

Where deflagration is to be practiſed, as in the proceſs for crocus antimonij of the London-College, Antihecticum Poterij, &c. the wind-furnace muſt be uſed; and the operation performed in a crucible, raiſed on a ſmall earthen ſtand, about two or three inches above the bars. The matter ſhould be thrown in gradually, with great caution; eſpecially when the crucible is filled to any conſiderable height; for the effervescence will frequently, otherwiſe, throw out a great part of the contents. But in the preparation for the crocus metallorum, according to the former proceſſes, a method has been taken to avoid the uſe of any furnace, for the effecting the deflagration, the particulars of which we ſhall exhibit in its proper place: only an iron pot, ſuch as is uſed for culinary purpoſes, ſhould be provided for the performing this proceſs: its magnitude muſt be ſuch as will admit its containing all the ingredients together, which are intended to be uſed.

## *Of filtration.*

Though this ſimple operation has been hitherto much neglected, and the common apparatus very imperfect; yet it is of great conſequence, in commercial chemiſtry, that there ſhould be ſome method, by which it may be performed,

performed, with eaſe and expedition, where great quantities come in queſtion.

Filtration is generally practiſed, by means either of flannel cloth, or paper: for the firſt of which, the common method of ſtraining through a bag of a conical form, which kind was formerly called Hippocrates's ſleeve, is convenient enough; but, where paper is required, the earthen cullenders, before deſcribed, p. 32, ſhould be uſed.

As the end of filtration is of two kinds, the one to purify fluids from any ſolid bodies, they contain, of a feculent nature; the other, to free, ſome precipitated powder or body, from the ſuperfluous fluid with which it is mixed; the means muſt be ſomewhat varied. In the firſt, paper, if it be of the right kind, is ſufficient; but, in the other, coarſe cloth ſhould be put over the paper; otherwiſe, in taking the filtred maſs from it, parts of it will unavoidably intermix themſelves with, and incurably foul, the matter.

The manner of uſing the earthen cullender, is to ſet it upon a proper wooden ſtand, of a ſquare form; in which it muſt hang by its edges. Under it muſt be placed a glaſs receiver, with a large funnel of the ſame ſubſtance, the diameter of whoſe mouth muſt be larger than the bottom of the cullender, that the ſtreams or drops, which fall from the holes, may be caught by the funnel, and run through its pipe into the receiver.

In ſetting the filters of this kind to work, great care muſt be taken, to accommodate rightly the paper to the cullender, as well as to pour the fluid very ſlowly into it at firſt. For otherwiſe, the paper will certainly burſt, and delay the operation by fouling all the veſſels with the unfiltred matter.

There is not any kind of paper, at preſent manufactured, which is ſo good for this uſe as might be: but the beſt, that is to be had, is the ſort called bloom paper; though even that frequently is ſo faulty, as not to anſwer, in almoſt any degree, the end: where it is found to be of ſo looſe a texture, as to relax, in ſuch manner, as not to bear the weight of the fluid, poured upon it; or where otherwiſe the fluid itſelf is of ſo relaxing a nature, that it deſtroys the texture even of good paper; a coarſe linnen cloth muſt be uſed, along with the paper, even though the purification of the fluid, only, be the end. But in this caſe, it muſt be uſed differently from the manner before directed. For the paper muſt here be put over the cloth, inſtead of being under it: as the deſign of uſing both, is only to give ſtrength to the paper.

In filtering large quantities, it will be frequently found, that after the paper has been ſoaked in the wet, for ſome time, the operation will proceed very ſlowly: the ſwelling of the ſubſtance of the paper, as well as the foulneſs of the fluid, diminiſhing, and at laſt choaking up, the percolating pores. In this caſe the

paper

paper ſhould always be changed, immediately after the filter ceaſes to run moderately; otherwiſe the operation would be intolerably tedious.

## *Of levigation.*

When great quantities of teſtaceous or cretaceous powders are to be levigated, the moſt cheap and expeditious method of operation is by the horſe-mills, beforementioned; where the ſame machine, that grinds, likewiſe ſearces the matter.

This ſo much ſhortens the work, that the wholeſale dealers find conſiderable advantage, in putting out quantities of materials for powders, to a perſon, who has erected a machine of this kind; and levigates the ſeveral ſpecies of bodies at certain rates: but, beſides the impoſitions, which theſe methods of intruſting others, with the preparation of medicines, of which the genuineſs is not eaſily diſtinguiſhed, gives room for, by exchanges or adulterations. The powders can never be made of near ſo great a degree of fineneſs, by this manner of grinding and ſearcing, as when levigated, by the muller on a proper ſtone, or marble, eſpecially, if the following method (uſed originally by the preparers of colours, and called by them waſhing over) be ſuperadded to the levigation.

The matter being firſt well levigated, or, if it be a cretaceous body broken, to a groſs powder, by pounding, let it be put in a deep veſſel

veſſel almoſt full of water, and there well ſtirred. Then having reſted a ſhort time, that the groſſer parts may ſink to the bottom, let the water and finer part, yet ſuſpended, be poured off into another veſſel; and ſuffered to ſtand at reſt, till the powder, poured off with the water, has totally ſubſided: let the clear water be then poured back, into the firſt veſſel, with great care not to diſturb the ſubſided powder, and let the ſtirring, decantation, &c. be repeated as before, ſo often as ſhall be found neceſſary, to ſeparate all the powder, which is of ſufficient fineneſs. The remaining groſſer part may be again ground; and the ſame treatment continued, till the whole of the matter be obtained fine. By this method, executed with care, impalpable powders may be had, with great eaſe, from even the hardeſt bodies; and chalk, tobacco-pipe-clay, and ſuch other earthy ſubſtances, as grow ſoft in water, may be freed from ſand or other impurities, and rendred fine, without grinding.

### *Of chryſtallization.*

Where only moderate quantities of ſalts are required to be chryſtallized, this operation is beſt performed, by the large glaſs receivers, &c. mentioned p. 33, into which, the ſolution of the ſalts being put, and continued till the chryſtals be duly formed, the fluid muſt be firſt poured off, into another receiver, and then the receiver and baſket, containing the cake

cake of chryſtals, reverſed over the baſket-work funnel, and there ſuffered to remain till the fluid be drained off; the ſalts muſt then be laid upon a board, gently ſloping, till they be of a proper dryneſs.

Where very large quantities of ſalts are to be chryſtallized, the leaden ciſtern, &c. mentioned p. 33, muſt be employed. The ſolution being drawn off from the boiler into the ciſtern; and the chryſtals, when they are formed, taken out, and put into the baſkets placed over it, till the fluid be drawn from them; and then laid to dry on the flat frames of baſket-work.

The great object of art, in chryſtallization, is the making the ſolution of a due ſtrength: for, if it be not ſufficiently ſaturate, the produce of chryſtals will be ſmall; and if it be overcharged, the ſalt will ſhoot ſo ſuddenly, that a great number of very ſmall chryſtals, like powder, will be formed; and coaleſce, in a kind of cake, on the ſurface of the containing veſſel; which, mixing with the larger chryſtals, that will ſhoot afterwards, will make them appear dull and leſs ſightly. It is, therefore, very requiſite to obſerve the due point of ſaturation: which may be gained, by bringing the ſolution to that ſtate, in which it will afford no chryſtals till it be cool, and then produce, in a ſhort time, ſhoots like needles, inſtead of the powder beforementioned: which will happen in moſt kinds of ſalts, where the chryſtals are of a long form, if the ſolution be charged in a

proper degree. It may be eaſy, for any, who deſire to perform this operation with accuracy, to find out the ſpecific gravity of the ſolution of each kind of ſalt when duly ſaturated for chryſtallizing; which, being once known, is a ſtandard for regulating their proceedings by the moſt eaſy means. But proper allowance muſt be made for the ſeaſon of the year; for, in ſummer, ſalts are much more diſpoſed to ſhoot than in winter; and the ſame muſt be obſerved, likewiſe, with regard to the degree of heat, or cold, in the place where they ſtand to ſhoot. When from accident of weather, or ſituation, they are kept warm, the ſolution may be ſtronger, and much longer time muſt be given for the formation of the chryſtals: the contrary will hold good with reſpect to winter, or accidental cold.

It may be taken as a certain principle, likewiſe, that, whenever ſalts ſhoot faſt, the ſingle chryſtals will be proportionably ſmaller.

## SECTION III.

*Examination of the ſameneſs of ſeveral ſubſtances, which make a part of the materia medica under different denominations, without any eſſential diverſity: being neceſſary for the determining, how far many ſubſtitutions are allowable.*

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*Of the ſameneſs of all fixt alkaline ſalts, from whatever vegetables, or parts of vegetables, they may be produced.*

The fixt alkaline ſalts of vegetables can be produced, by no other means, than the incineration, or burning to aſhes, the proper parts of thoſe vegetables, which can afford them. For all vegetables do not afford them, in any degree; and ſome, only, from certain parts. If, however, the fixt alkaline ſalts, thus obtained, from any vegetable whatever, be expoſed to a ſtrong and continued heat, or be deflagrated with nitre, they will be found, on the niceſt examination, by any experiment, to be alike in all their qualities; except that difference, which the degree and duration of the heat, they have been expoſed to, will be found to cauſe, promiſcuouſly, in all.

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The ſuppoſed difference, therefore, betwixt the ſalts of ſeveral kinds of vegetables, as of wormwood, broom, or tartar, does not conſiſt, really, in the ſalts themſelves; becauſe, it may be deſtroyed by calcination in a ſtrong heat; and yet, there being an apparent difference, in ſuch as have not been ſtrongly calcined, it muſt neceſſarily ariſe from the admixture of ſome other ſubſtance, with the ſalts; that is expelled or taken away by the heat of a ſtrong calcination. This can be nothing but part of the oil of the vegetable; which, being attracted by the ſalt, remains conjoined with it, even though the ſalt be purified by ſolution, and filtration; and being thus inſeparable from the fixt alkaline ſalt, while it remains ſuch, by means of water or any other medium, except intenſe heat, appears to mark the ſalt with a ſpecific character; giving occaſion to ſuppoſe, a real diverſity, betwixt the ſalts of different vegetables, or parts of them, dependent on the different nature of the vegetables: whereas there is, in fact, no difference, but betwixt thoſe, which have undergone incineration only, and thoſe which have undergone a ſtronger, or more continued calcination; as in the inſtance of the ſalts of wormwood and tartar. For if the ſalt of wormwood be deflagrated with nitre, or ſubjected to a ſtrong calcination, or the ſalt of tartar combined with a ſmall quantity of the burnt oil of wormwood, they will then reciprocally change their characteriſtic

qualities; and each will acquire that, which before diſtinguiſhed the other from it.

From experience, rather than philoſophic knowledge of the truth of this principle, ſalt of tartar has been ſubſtituted, either by the preſcribers or compounders, in the ſaline febrifuge draughts, very generally, in the place of ſalt of wormwood; and purified pearl-aſhes are ſold, by the wholeſale dealers, almoſt conſtantly, in the place of ſalt of tartar: and where the appearance of ſalt of wormwood muſt be preſerved, in conformity to the prejudice of thoſe who have not yet got over this error, either the ſalt of tartar, or purified pearl-aſhes, are rendred of a proper degree of foulneſs, to give them the brown colour of the genuine ſalt of wormwood; and paſſed for it.

The ſameneſs of fixed alkaline ſalts has been, however, oppoſed by ſome perſons, who, in very nice experiments, have found the ſalt of wormwood a menſtruum for particular bodies, which the ſalt of tartar would not act upon, in a ſimilar manner; the difference in theſe experiments does not, however, lie, in the ſalts, from their own nature, but in the preſence of another ſubſtance conjoined with the ſalt of wormwood, to wit, the burnt oil of that vegetable, which aided the ſalt in its operation on the bodies by which the experiment was made: for freeing the ſalt of wormwood, from this impurity, or giving it to the other, will eaſily ſhew the fallacy of theſe experiments,

periments, with reſpect to the concluſion from them, of the actual difference of the ſalts.

In order to judge, nevertheleſs, how far the ſubſtitution of one kind of fixt alkaline ſalt, in the place of another, may be allowable, it is neceſſary to conſider, whether a part of the efficacy of ſuch ſalts, as medicines, may not reſide in the oil, or appertain to them, in ſome manner, in conſequence of this impure ſtate.

With reſpect to the efficacy, which the oil itſelf may poſſeſs, when we conſider it as a diſtinct part of the medicine, we muſt aſcribe it to the general properties, that belong to all vegetable oils when burnt. For (as we ſhall ſee below) all vegetable oils, or ſulphurs, after they have ſuffered the action of the fire ſo as to be burnt black, loſe the ſpecific qualities, they before had, as parts of the particular plant, which produced them; and acquire qualities commom to them all in this ſtate; differing only in the degree of thoſe qualities, according to the greater or leſs action of the heat, and according to the other elementary ſubſtances of the parts of the vegetables, in which they reſided.

If we therefore allow, that the oils peculiar to the plants, they are obtained from, retain no ſpecific qualities in this ſtate; the efficacy, they may give to the alkaline ſalts as a medicine, muſt conſiſt in thoſe, which are common to all burnt oils. And however the property of ſuch oils might ſometimes make for the intention of the remedy, yet the ſmall quantity, in

which they can be here adminiſtered, would take off from any ſtreſs, which could be otherwiſe laid upon them. But the fact is, that the alkaline and diſſolving qualities of the ſalt are thoſe alone, by which theſe medicines, in almoſt all caſes, produce their effects; and to theſe the additional preſence of the burnt oil is not at all neceſſary.

If the action of burnt oils, conſidered according to the ſmall proportion of it found in a doſe of alkaline ſalts, be inſignificant, even in caſes where its qualities might in ſome degree correſpond with the intention of the medicine; and if in other caſes, which are the far greateſt part, it is no way relative to the intention; it remains to inquire, whether by the combination of the oil and ſalt, a tertium quid, or third kind of ſubſtance may not be generated; which may have properties different from thoſe of the pure ſalt, diveſted of the oil; or of the oil while in its ſimple ſtate.

It muſt indeed be admitted according to what we have ſaid above, that the ſalt and oil conjoined may have ſome properties, different from the pure ſalt; but they are ſuch as appear foreign to the apparent cauſe of the medicinal efficacy of alkaline ſalts: for, as I before obſerved, the quality which belongs to them, as alkalies, in deſtroying of acids, and checking aceſcence in the viâ primâ, (ſo often the cauſe of chronic complaints,) with their power of diſſolving pituitous humours and concretions in the ſecretory veſſels, as well by their

own ſaponaceous power, as by their ſtrengthning the bile, account ſufficiently for their effects, in the cure of thoſe diſeaſes, for which they have been hitherto adminiſtered. And it would be a preſumption, ill founded, to ſay, that, becauſe the action of the ſalt was ſomewhat varied, by its combination with the oil, in reſpect to ſome particular bodies of a nature foreign to thoſe, which relate to the human conſtitution, (as in a very large field of experiment might be found to be equally true of almoſt any compoſition that could be made) it was therefore owing to theſe obſcure, partial, and weak, and not their very powerful general qualities, (tho' accounting clearly for all the particular effects,) they owed their medicinal operation.

It may therefore be deemed an allowable (that is to ſay, with reſpect to the medicinal effects, an innocent) ſubſtitution, to uſe the fixt alkaline ſalt of one vegetable, or part of a vegetable, for that of another: provided there be no impurity, or defect as to the general nature, in the ſalt ſo uſed: and it would be much better, in order to avoid impoſitions with reſpect to price, and thoſe other frauds of the ſame kind, with which the preſent practice is greatly replete, that the college would eſtabliſh this doctrine in their pharmacopeia; and preſcribe only fixt alkaline ſalts in general: leaving it to thoſe, to add the burnt oil of wormwood, or any other vegetable, in their extemporaneous preſcriptions, who may think it appoſite to the particular intention of cure.

*Of the ſameneſs of volatile alkaline ſalts, from whatever animals, or parts of animals, they may be produced.*

What is above ſaid of the fixt alkaline ſalts of vegetables, is equally true of the volatile alkaline ſalts of animals. For, nature having formed all theſe kinds from the ſame elements, thoſe combinations, which give the ſpecific form to each, are deſtroyed by the reſolution made by fire or putrefaction; and new ones are produced, not according to thoſe modes of combination, which the fire deſtroyed, and which are producible only by the power of vegetation; but according to the general qualities of the elements, and their proportionable quantities to each other.

This will be found true, with reſpect to volatile alkaline ſalts, by experiments made on the ſame principle with thoſe beforementioned, for proving the ſameneſs of the fixt alkaline ſalts. For, if volatile alkaline ſalts be ſo purified by rectification, or any other method, that the oil be intirely taken away from them, they will appear alike in all their qualities; and, alſo, if the oil of one kind be added to the other, in a pure ſtate, it will reſemble that intirely from which the oil was borrowed. As, for example, if ſalt of hartſhorn be commixt with ſpirit of ſalt, and conſequently formed into ſal Ammoniacum, and the volatile ſalt afterwards again ſeparated, by the addition of fixt alkaline ſalts,

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it will be found, then, to be the ſame in every point, as if ſeparated from the ſal Ammoniacum brought from the eaſt: or, if to the volatile ſalt of ſal Ammoniacum, obtained from the eaſtern kind, the oil diſtilled from hartſhorn be added, the ſalt will perfectly reſemble that extracted from the horn.

With reſpect to the pure volatile alkaline ſalt of any animal, or part of an animal, the volatile ſalt obtained from ſal Ammoniacum might well be ſubſtituted; and the ſame holds good with regard to what is called volatile ſpirit, which is, in fact, only the ſalt diſſolved in water: but thoſe, which are uſed in medicine under the name of particular ſalts or ſpirits, are greatly replete with the diſtilled oil, that ariſes along with the ſalts; and which is not, as the burnt oil in the caſe of the fixt alkaline ſalt of vegetables, either irrelative, or inadequate to the intention of the medicine; but, on the contrary, a proper and eſſential part of it: and therefore volatile ſpirit of ſal Ammoniacum, cannot be ſubſtituted for ſpirit of hartſhorn, without a material defect; unleſs an equivalent quantity of the ſame kind of oil be previouſly conjoined with it. But if a volatile ſpirit, or ſalt, be drawn from any other ſort of animal ſubſtance, and be replete with an oil of the ſame kind, in a ſtate equally, or more, ſuitable to the intention of this medicine, they may well be ſubſtituted for thoſe of hartſhorn, vipers, or any other particular materials, which the fancy of perſons ignorant in principles of this kind may

may direct. And the ſubſtitution of any other volatile ſpirit, inſtead of ſpirit of hartſhorn, provided it be duly replete with volatile ſalt, and diſtilled animal oil of the more ethereal kind, may indeed be conſidered as a fraud in commerce, but is in fact an improvement in medicine.

### *Of the ſameneſs of oils, diſtilled from the ſeveral kinds, or parts of animals.*

There is no part of any animal, which will afford an oil by diſtillation, till the ſame be burnt, and the oil rendred ethereal by heat: yet, nevertheleſs, not only the adipoſe, or fat parts, but even any other, if they be expoſed to a certain degree of heat, neceſſarily afford an oil which riſes from them, in the ſtate of vapour; and may be collected by proper condenſing veſſels. In this burnt ſtate, the form and ſpecific qualities, which the oils might have in their original ſtate, are loſt; and, like fixt or volatile alkaline ſalts, they put on a general nature, which has no dependance on, or affinity with, the ſpecific qualities of the animals, or parts, whence the oils are extracted, but is ſimilar in all.

There is, however, a variation in diſtilled oils, not found in alkaline ſalts; though none ariſes from the peculiar qualities of the animals, or parts that afford them; for, in all the ſeveral parts of animals, the ſulphureous principle, or phlogiſton, which is the proper eſſence of all oils, is more ſtrongly combined, in ſome of the ſubſtances, which conſtitute thoſe parts, with

with earth and acid, than in others; and, being thus attracted by the earth, or reduced by the controlling power of the acid nearer to the ſtate of a fixt ſulphur, raiſes with itſelf, in the diſtillation, a greater proportion of theſe heterogeneous bodies; and, conſequently, produces a groſſer and leſs volatile oil; in which, the heat not having made a more perfect reſolution of the elements, it is yet ſubject, in ſome degree, to that tendency to the putrefactive analyſis, that is common to all the parts of animals: while, from other ſubſtances, in which the phlogiſton is leſs intangled with the earth, or acid, the oil riſes of a more pure, ſimple, and, conſequently, unchangeable nature; having that greater degree of lightneſs, volatility, and limpidneſs, which brings it to what is called the ethereal ſtate.

The difference, therefore, in oils diſtilled from animal ſubſtances, not ariſing from any difference of the kinds of animals, or parts of them, whence they are obtained: thoſe extracted from one kind may be, with propriety, ſubſtituted, for thoſe extracted from others; provided the general qualities of ſuch oils, be ſuch as are beſt ſuited to the particular purpoſe then in queſtion. And though the knowledge of this principle concerns not greatly the practice of medicine, with reſpect to the uſe of the oils in their ſimple ſtate, as they are ſeldom ſo adminiſtered; yet, as the preſence of ſuch oils give in part the efficacy to ſome generally eſteemed capital medicine, as well as to others, celebrated by particular

ticular perſons only, it was neceſſary to be underſtood, in order to judge of the allowableneſs of certain ſubſtitutions we ſhall have occaſion hereafter to ſpeak of.

*Of the ſameneſs, in quality, of the burnt oils of vegetables, from whatever kind produced.*

What has been before ſaid of the alkaline ſalts, and the diſtilled oils of animals, is equally true, with reſpect to the burnt oils of vegetables: for the fire intirely deſtroys thoſe combinations, on which their ſpecific form and properties, in the plants, depend; and produces ſuch, as relate only to the general properties and proportion of the elements, of which all are conſtituted. Where, therefore, any ſuppoſed difference, in medicines, lies in the burnt oil, it may be concluded of no conſequence; nor does it matter from what different vegetables, or parts of them, any ſuch medicine be prepared; but one may equally well be ſubſtituted for the other, if the form and general qualities are correſpondent in each. This muſt not, however, be underſtood to extend to ſuch oils, as ſubſiſt, in an ethereal or eſſential ſtate, in the vegetable; and may be obtained, by diſtillation, with leſs than a burning degree of heat.

*Of*

*Of the ſameneſs of the calcined earths of all animal, and vegetable, ſubſtances.*

The earth, which makes the baſis or ſolid part of all animal and vegetable ſubſtances, is of one kind; and is never ſo changed, by its combination with other bodies, but that a perfect calcination will reduce it again to its original ſtate.

This being admitted, it reſults, that the ſeveral teſtaceous or calcined earths of animals or vegetables, uſed in medicine, can be no ways different, with reſpect to the earth itſelf: but that where there is a real diverſity, it muſt be owing to the preſence of ſome other ſubſtance. In thoſe, which have undergone no calcination, or but a ſlight one, a greater or leſs proportion of the animal gluten, or oil which formed it, will neceſſarily be found: and, in ſome, where the calcination is more perfect, the ſubſtance, which gives quicklime its peculiar action, will be generated; as in the caſe of the oyſter ſhells. But, if the calcination be perfect, and the calcarious gas be ſeparated by frequent ablutions, the earth will at length be found the ſame, in every inſtance.

The teſtacea, therefore, in all which, there is ſome quantity of the animal gluten, though the proportion be different according to the different tenacity of each kind, may be ſubſtituted for each other; as there is no diverſity in them, but what relates to the proportion of gluten; and conſequently not to the qualities of the earths,

earths, on which their medicinal virtue depends; that is to ſay, to their power of abſorbing, or more properly neutralizing, acids.

The animal and vegetable earths of all kinds, perfectly calcined, may likewiſe be ſubſtituted for each other: if the quality, peculiar to quick-lime, be not wanted; and thoſe, in which this quality may be found, be freed from it by waſhing.

But, where calcined animal ſubſtances are to be uſed as lime, there will be found an eſſential difference, in the produce of the calcination, with reſpect to different kinds; which difference, though not really exiſting in the earths themſelves, but cauſed by their combination with another ſubſtance, yet being neceſſary to the intention of the medicine, renders it proper, that the particular kind of animal ſubſtance, preſcribed, ſhould be ſtrictly adhered to. For, if the queſtion ſhould be, with regard to the ſubſtitution of calcined hartſhorn for oyſter-ſhells; we ſhould put a ſubſtance that wants, or but in a very ſmall degree poſſeſſes, the peculiar quality of quick-lime, for one, which has it in a very great degree.

It is uſual to ſubſtitute chalk for all the teſtacea, and calcined earths of parts of animals; but this is by no means allowable: for there is not only an eſſential diverſity, in the medicinal qualities, betwixt foſſile earths, and thoſe of animal or vegetable ſubſtances; but even betwixt almoſt every different ſpecies of the foſſile earths themſelves: and though the alka-

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line qualities of the chalk gives it a great affinity to the animal earths, as operating in the ſame intention; yet an aſtringent ſtyptic quality, ſuperadded to its alkaline, renders it, in ſome caſes, by no means a fit ſubſtitution for the teſtacea.

*Of the ſameneſs of vinous ſpirits, from whatever materials obtained.*

As nothing can produce vinous ſpirit, but the ſaccharine juice of vegetables, changed by fermentation; ſo, when that change is made, there is not the leaſt difference betwixt the ſpirits produced, from whatever vegetable, or part of a vegetable, they may be obtained.

This will be evident, on a high rectification of any kind whatever; for the alcohol will appear the ſame, even on examination by the niceſt experiments.

The difference, therefore, of thoſe kind of vinous ſpirits, which go under different names, is not in the ſpirit itſelf, but in the admixture of ſome quantity of the eſſential oil of the vegetable, or particular parts of them, which ariſes in the firſt diſtillation, together with the ſpirit; as in the caſe of rum: and ſometimes alſo in the admixture of the acid of the fruit, which, coming over with it, dulcifies the ſpirit, in the ſame manner, as other acids; as in the inſtance of brandy. But the manner of counterfeiting the peculiar qualities of the ſeveral kinds, as well as the deſtruction of them, when natural,

natural, by repeated diſtillations, all evince the diverſity not to lie in the ſpirit itſelf.

In tinctures, therefore, and all caſes, where the flavour is regarded, the kind of ſpirit preſcribed ought to be uſed; to render the medicine what it is intended to be: but, where a ſubſequent diſtillation is to be made, or where the flavour is covered by the admixture of drugs of very ſtrong taſte, any kind of ſpirit may be uſed, without the leaſt injury to the compoſition: and, indeed, with reſpect to the medicinal efficacy, it is matter of indifference in all caſes.

*Of the ſameneſs of the acid ſpirit to be obtained, from ſulphur, vitriol, ſal catharticum amarum (commonly called Epſom ſalt), and alum.*

The acid gas commonly called oil of vitriol, or the vitriolic acid, has been formerly ſuppoſed to be peculiar to the ſalts of the vitriolic genus; and not, elſewhere, to be naturally found: but later experience, and more rational inquiries, concerning ſubjects of this kind, have informed us, that it is abſolutely the ſame with the acid obtained from ſulphur by burning: and the one is now promiſcuouſly ſubſtituted for the other; or rather, the acid of ſulphur is now almoſt univerſally ſold for, and under the name of, the other: as, by the late improvements of the methods of diſtillation of it, this acid can be extracted, much more profitably, from ſulphur than vitriol.

The

The acid part of the ſal catharticum amarum, and alum, is alſo the ſame with that of vitriol and ſulphur: and though it is rarely diſtilled from them, as it can be cheaper obtained from the other bodies; yet the ſalts themſelves may be, occaſionally, uſed, for neutralizing fixt alkaline ſalt, and forming the ſal polychreſt, or vitriolate tartar; as it may be depended on, that whatever acid is imparted, to any other body, from ſulphur, vitriol, ſal catharticum, or alum, is abſolutely of the ſame kind.

*Of the ſameneſs of vitriolated tartar, ſal polychreſtum, ſal prunellæ, and the ſal enixum.*

The vitriolated tartar, being immediately made by the admixture of vitriol, and fixt alkaline ſalt, and the ſal polychreſtum, being formed from nitre, and ſulphur, deflagrated together, the acid of the ſulphur being ſet looſe in the deflagration to act on the alkaline baſis, which is fixt alkaline ſalt, it cannot be denied, but that, if the acids of vitriol and ſulphur be the ſame, as we have before laid down, and that the acid of the ſulphur combine with the alkaline part of the nitre, as is evident, the ſalt produced by each method muſt be the ſame: there being no difference in effect, whether the elements are mixt ſimply together, or combined after their ſeparation from other bodies, with which they were conjoined, in the manner that happens in the deflagration; where the proper acid of the nitre, and the phlogiſton of the ſulphur

flying away, in the exploſion, leave the acid of the ſulphur, and the alkaline part of the nitre, at liberty to act on each other.

The ſal prunellæ, as made according to the former, and moſt general proceſſes, is exactly the ſame as the ſal polychreſt: equal parts of nitre and ſulphur, being ordered to be deflagrated together for the firſt; and as much ſulphur, as will deflagrate with the nitre, for the other: only the ſal prunellæ was caſt into cakes, and the ſal polychreſtum chryſtallized. There can remain no doubt, therefore, of their being the ſame with each other; and with the tartar vitriolate.

The college of Edinburg have, indeed, after Lemery, ordered the ſal prunellæ to be prepared with a much leſs quantity of ſulphur, than is ſufficient to analyze all the nitre, by deflagration; and the ſal prunellæ, ſo made, will, conſequently, be a compound of nitre, and ſal polychreſt: but this method of preparing it has, I fancy, prevailed very little hitherto: the proceſſes of Quincy's Diſpenſatory, and the other older books, being moſt generally followed with regard to it.

Sal enixum being formed by the addition of oil of vitriol to nitre; which oil of vitriol diſpoſſeſſes the proper ſpirit of the nitre of its alkaline baſis, and combines with it; and this alkaline baſis being, as was ſaid before, fixt alkaline ſalt; it is evident that this ſalt is the ſame with the vitriolate tartar, ſal polychreſtum, and ſal prunellæ: being, like them, formed only

of fixed alkaline ſalt, neutralized by the vitriolic acid.

All the above mentioned ſalts, therefore, or any other preparation of fixt alkaline ſalt, and the acid of ſulphur, vitriol ſal catharticum, or alum, in which a neutral ſalt is formed, may be fairly ſubſtituted for each other. The elements being, in fact, the very ſame: but the reſiduum of the nitre and oil of vitriol, in the diſtillation of ſpirit of nitre, which is ſold moſt generally in the ſhops under the name of the vitriolate tartar, muſt be excepted, till it be duly neutralized, for it commonly abounds with a great quantity of redundant acid left behind with it in the retort after the diſtillation.

# PART II.

Of the preparation of chemical medicines: with the ſeveral ſubſtitutions and adulterations practiſed in relation to them; as alſo the beſt means of detecting ſuch practices.

## SECTION I.

*Of the preparation of thoſe medicines, where ſaline ſubſtances make the whole, or principal part of the ſubject.*

### *Preparation of ſpirit of hartſhorn.*

LET pieces of hartſhorn be diſtilled, with a fire gradually augmented, almoſt to the greateſt degree. Spirit, ſalt, and oil will ariſe: and, the oil being taken from them, let the ſpirit, and ſalt, be mixt together again; and diſtilled with a very gentle heat, and they will both riſe purer: which operation being ſeveral times cautiouſly repeated, and a proper part of the ſalt taken away to be reſerved for ſublimation, the ſpirit will become limpid as water, and have a grateful ſmell.

*Note.*

Spirit of hartſhorn is one of the capital articles of the chemical pharmacy, and has undergone a greater revolution, in its price, and manner of preparation, than any medicine whatever. A few years ago, the loweſt rate it was ſold for, in the moſt wholeſale way, was half a crown, or three ſhillings per pound: it has ſince been reduced to the low price of five pence or a groat; at which rate, a great part of the conſumption has been ſupplied, by the preparers, to the wholeſale dealers. This is done by an intire ſubſtitution of other volatile ſpirits, diſtilled from ſubſtances much cheaper than hartſhorn: and by the treating even theſe in ſuch a manner as diſguiſes their real ſtrength; and makes even very weak paſs for extreme good ſpirit of hartſhorn, though ſold as at this exceſſive low price: whereas genuine ſpirit of hartſhorn, prepared as the above proceſs directs, can never be afforded with reaſonable profit for leſs than two ſhillings per pound.

It is not, however, eſſential, that this medicine ſhould be prepared from horn; but rather improper: for volatile ſpirits, obtained from this ſubſtance, however often they may be rectified, at leaſt within any moderate compaſs, are apt to grow brown, foul, and fœtid: ſo that, if kept for any length of time, they become nauſeous and unſightly: whereas, if diſtilled from bones properly prepared, they require much

much leſs rectification; are more palatable and grateful to the ſtomach; and will retain their limpid and colourleſs appearance for a conſiderable duration, a quality very valuable to apothecaries, eſpecially thoſe in the country, who cannot be continually renewing their ſtock.

The redundance of, and unfavourable quality in, the burnt oil of horns, to which this unfitneſs to produce good volatile ſpirits is owing, ariſe from the great quantity of the animal gluten which all corneous ſubſtances contain: this gluten abounding in all parts of animals in proportion to their tenacity; of which indeed it is the cauſe: and being, in fact, nothing but oil mutually attracting and attracted by the earth, which conſtitutes the ſolid baſis of the parts.

If we admit all volatile ſalts to be the ſame; and conſider, that this compound, we call ſpirit of hartſhorn, conſiſts of water, volatile ſalt, and diſtilled animal oil; we ſhall ſee, that, as no difference can lie in the volatile ſalts, or water; it muſt, if there be any difference at all betwixt this ſpirit, and that diſtilled from any other animal ſubſtance, be in the oil only.

Now all diſtilled oils of animal ſubſtances, being likewiſe of the ſame nature; except that, by the action of the fire, ſome are higher exalted, and gaining a more ethereal nature, become leſs liable to putrefaction; while others, being leſs changed from their original groſſer ſtate, retain ſome tendency to putrefy; it muſt appear, that there can be no difference in volatile ſpirits, but in their being charged, in a

greater or leſs proportion, with oils that vary only in their exaltation, or approach to the ethereal ſtate; in the greater degree of which, conſiſts their medicinal excellence: as may be eaſily granted, when it is conſidered, in what intention they are taken. If, therefore, it ſhould be manifeſt, from experiment, that volatile ſpirit, extracted from prepared bones, or any other animal ſubſtance, contains a more ethereal oil, than ſpirit drawn from hartſhorn; it muſt conſequently be concluded to be a more efficacious medicine, as well as a much more grateful and convenient one, on the account above mentioned.

Dr. P, in his notes on this article, in the tranſlation of, the College-Diſpenſatory, ſeems to think, this ſpirit ſhould be diveſted as much as poſſible of the oil. For he places the perfection of the preparation in the number of rectifications: and on this principle, half a guinea an ounce has been charged for ſome quantities, ſuppoſed to be thus improved. But certainly there are limits to the proportion of oil that ſhould be thus ſeparated from the ſpirit: for if no oil were neceſſary to the conſtituence of the medicine; but that a pure volatile ſalt and water made its proper contents; it might be much better prepared, by making a ſolution of volatile ſalt of ſal Ammoniacum in water; or diſtilling ſuch a ſpirit from a ſolution of ſal Ammoniacum with ſalt of tartar: but the true compoſition of it, is not, from volatile ſalts and water alone;

lone; but from theſe with the addition of ethereal animal oil; which makes, with the others a volatile ſapo: the oil being evidently an ingredient, correſpondent to the intention, equally with the volatile ſalt; as may be gathered from its affinity with other ethereal oils, as of amber, or the aromatic vegetables, &c. Whichever of theſe notions we adopt, the ſpirit of bones ſeems ſtill preferable to thoſe of horn: and we ſhall principally inquire, how that can be beſt and cheapeſt prepared: but for the ſake of thoſe, who adhere to the old faith, as to the ſuperiority of the true ſpirit of hartſhorn, to other volatile ſpirits diſtilled from other animals, or parts of them, I ſhall firſt make ſome obſervations on the regular proceſs above given, and the beſt manner of performing it: pointing out, alſo, the defects of the apparatus generally uſed; and ſhewing how they may be beſt amended.

The pots, in which this diſtillation is made, are much too ſmall; being, in general, made to contain only three quarters of a hundred weight of the horn: whereas, with the ſame fire and trouble, double or treble the quantity might be diſtilled together, in larger pots. The reaſon for this unprofitable manner of working, has been the difficulty found in forming a proper apparatus, for condenſing the diſtilled vapour, when raiſed in a greater quantity than three quarters of a hundred, or a hundred weight of materials would afford. The moſt general way has been to uſe, as a refrigeratory, only a ſeries of glaſs allodials luted together,

and

and terminating in a glaſs receiver: but later improvements have introduced the uſe of a long tin tube, joined to the pot by one or two allodials placed next the pot, paſſing into a large earthen or ſtone jar, made cloſe at the top, and venting itſelf again by another tube of the ſame kind, terminating either in another ſuch jar, or a large glaſs receiver.

This has been found much preferable to the firſt method, of uſing glaſs allodials alone; but both of them are far inferior to that deſcribed in the next proceſs.

By the beſt of theſe methods, ſix or eight days are required, from the charging the pot, to the finiſhing the operation: for a conſiderable time is taken up, for the drying the lute; which is with much trouble laid on, and repaired, at ſo many different junctures: and, when this tedious part of the work is finiſhed, the fire muſt be very well regulated, otherwiſe the lute will be blown off, the ſtench become intolerable, and a very great waſte made of the produce of the operation; indeed a conſiderable waſte, and a very bad ſmell, will always attend this manner of working, even when beſt managed. There is indeed a way, that has been hitherto overlooked, from the almoſt univerſal ignorance in principles, of perſons concerned in theſe operations, of preventing greatly the ſmell and waſte with the worſt apparatus. For the force on the lute, being, in a great degree, owing to the air generated in that analyſis, which the fire makes of the elements

ments that compoſe the ſubſtances diſtilled; which air being incondenſible, as well as highly elaſtic, muſt ſomewhere find a vent, as its quantity augments; this air ſtraining the lute, cracks and opens it; and preſſing out through theſe cracks or openings, drives with it, likewiſe, the condenſible part of the vapour, eſpecially about the head, and firſt allodial, which are replete with ſuch vapour; becauſe the heat prevents almoſt any condenſation from being performed there. If, therefore, a proper vent ſhould be made in the receiver, or ſome diſtant part of the condenſing veſſels; by means of which, the lute may be kept free from its efforts, and remain intire: the rivus of air would paſs forwards to the vent of the extremity of the ſurface, and drive along with it the condenſible vapour that forms the diſtilled ſpirit; which thus coming, in its paſſage, in contact with the refrigerating ſurface of the veſſels, will be for the moſt part condenſed, and not blown out through the cracks, otherwiſe produced in the lute. This vent may be likewiſe carried into a ſmall tin pipe, communicating with the chimney, or aſh-hole; by which means, both the elaboratory, and places contiguous, may be kept free, in a great degree, from this troubleſome ſmell.

It would be much better, however, in all caſes, to uſe the worm, as a refrigeratory, in the diſtillation of hartſhorn; according to the directions given below: for though the ſalt would not be obtained, in this part of the proceſs,

ceſs, in ſuch proportion as when allodials are uſed: yet a conſiderable quantity may be taken out of the receiver, uſed in ſuch diſtillation; and what more may be wanted, may be got out of the receivers, uſed in the rectification; if they be taken off before the ſpirit begins to come over and waſh the ſalt off the ſides: and the ſalt procured by theſe methods, will be much freer from oil; and, conſequently, much leſs troubleſome in rectifying, than that taken out of the allodials: it being exactly the ſame, in the reſult, which way it is ſeparated from the diſtilled ſpirit; as there will the ſame proportionable quantity remain in it after what is taken.

Another defect in the common management of the genuine ſpirit of hartſhorn, is, the want of a more commodious method of ſeparating, immediately after the diſtillation, the foul oil, which comes over with the ſpirit and ſalt, and cauſes a conſiderable waſte, when taken out by the methods now uſed: and, which not being very efficacious in freeing it from the oil, occaſion the ſpirit to be injured by being kept too long commixt with what is left floating upon it. This may be beſt remedied by employing the tritorium deſcribed in the introduction, in the manner below ordered; and treating the ſpirit according to the ſubſequent directions there laid down.

In the proceſs of the college above given, the ſalt is ordered to be rectified along with the ſpirit, before its being taken away to be ſublimed;

limed; which is one of the moſt effectual methods of giving it ſome degree of purity. But the more common way, is to ſeparate it from the ſpirit, immediately after the diſtillation from the materials; by which a conſiderable delay is avoided in the rectification of the ſpirit.

The number of rectifications intimated to be neceſſary in this proceſs, are likewiſe frequently curtailed: though, in order to the making the genuine ſpirit keep tolerably, there ought to be four, and theſe performed at ſome diſtance of time from each other; the oil ſwimming on the ſurface of the fluid being carefully ſeparated after each: for fewer rectifications, performed at intervals of ſome length, will render the ſpirit more pure than a greater number, quicker repeated: as the oil can be much more copiouſly ſeparated, from the ſpirit, by rectification, after the natural ſeparation of it by its own tendency, which ſhews itſelf by a turbidneſs and ſediment, than, while they remain more perfectly united, as in the limpid ſtate they are found to be, for ſome time after each rectification.

*Method of making ſpirit of hartſhorn, fictitious, with reſpect to the materials, but perfect, with regard to the qualities correſpondent to the intention of medicine.*

Take any quantity of the bones, from whence the fat has been extracted, by thoſe who

who collect them for that purpose: distill them, and rectify the salt and spirit together, taking out a proper quantity of salt, which will rise before the spirit, by changing the retort before the salt be melted by the spirit: rectify the spirit twice more; and, after keeping it for some time, filter it through paper.

*Note.*

These materials, both from their own nature, and the previous preparation in the freeing them from all oily substances, by the long boiling, practised by the people, who collect them, are the best and cheapest materials, from whence this spirit could possibly be drawn: they may be purchased, in London, at five shillings per ton; and they afford a very pure spirit, with very little trouble, as I have before mentioned.

The distillation should be performed in the pot, with the worm and other parts of the apparatus, as described p. 35, into which, being put, and the cover placed on it; which, without lute, will make a close joint, the distillation may be immediately begun; and will be over, with proper management, in sixteen or eighteen hours.

The

The end of the bending pipe, added to the end of the worm, for that purpoſe, muſt be let into the neck of a large receiver placed under it; and the tin pipe, for carrying off the ſmell, ſhould alſo have its bending end put into the neck of the receiver; and the remaining opening of the mouth may be made good, by ſome moiſt, but ſtiff, clay.

When the receiver appears of a proper fulneſs, it ſhould be taken away; and another put in its ſtead, in the ſame manner as the firſt; and this ſhould be repeated as often as they fill. The receivers ſhould be emptied, by means of a tin funnel, into the tin or pewter tritorium deſcribed p. 30; and the crude ſpirit kept there till it be wanted for rectification; or, if the tritorium will not contain all that may happen to be made, this ſpirit may be drawn off, from it, into a proper bottle, to make room for the freſh, through the lower tube, which alone muſt be uſed for this purpoſe; the upper one being deſigned for drawing off the oil, which will float on the ſpirit, and may be eaſily taken away from it, by this method, when there is a proper quantity in the tritorium, and the ſpirit raiſes it to a proper height.

If, as will ſometimes happen towards the end of the diſtillation, the worm ſhould be ſo choaked up with the ſalt, ariſing along with the ſpirit, that the paſſage of the vapours may be obſtructed, which may be perceived by the appearance of the ſmoke through the juncture

of

of the cover and pot, the ſtopper ſhould be immediately taken out of the ſmall pipe in the upper part of the worm; and, a ſmall tin funnel being put in it, water ſhould be poured into the worm; which will force its way, by melting the concreted ſalt: and this muſt be repeated till the paſſage appear free, by the running of the water into the receiver without any ſign of obſtruction.

The whole worm muſt be, likewiſe, filled with water, by the ſame means, as ſoon as the operation is finiſhed: the end of the ſmall bending pipe, at the extremity of the worm, being firſt ſtopt with a cork: and this water may be left in the worm, till the uſe of the pot is again wanted; when it muſt be taken out, and put into the tritorium along with the other ſpirit, which it will nearly equal in ſtrength, by having diſſolved the ſalt concreted in the worm, according to the intention of its being put there. This ſhould be carefully remembered: for, on the clearing the worm, by this means, of the ſalt, which is neceſſarily collected there, each diſtillation, depends the practicability of its uſe.

After the firſt, and every other diſtillation, the oil ſwimming on the ſpirit ſhould be carefully ſeparated from it; which may be done, by paſſing this ſpirit through a large glaſs funnel, in the bottom of which, a piece of cotton is ſo placed, that the fluid paſſing through gradually, the oil may be kept from following the

ſpirit, by removing the funnel after the ſpirit is gone through it.

The oil ſeparated, in the ſecond and third rectifications, ſhould be put into a phial, and preſerved; in order to make the fictitious ſalt of hartſhorn.

After the laſt rectification, the ſpirit ſhould be filtered, by means of the cullender, &c. deſcribed p. 32 : and, if it be kept a conſiderable time, the filtering may be repeated before it be ſold, if the quantity be conſiderable.

This volatile ſpirit is, with regard to the medicinal intentions, equal in all reſpects, and in ſome ſuperior, to the true ſpirit of hartſhorn; for which at preſent it is generally ſold: as is ſometimes, likewiſe, the following kind.

*Compendious preparation of a volatile ſpirit, reſembling the above, and the true ſpirit of hartſhorn.*

Take volatile ſpirit of ſal Ammoniacum, obtained by chalk, or ſalt of tartar, but without lime, one gallon ; or two pounds of ſal Ammoniacum, and the ſame quantity of dry pearl aſhes, may be uſed, with a gallon of water, inſtead of the ſpirit; to this add, of the crude ſpirit of hartſhorn, or bones, half

a gallon: diſtill them, as in the rectification of ſpirit of hartſhorn, and draw off the ſpirit, while it comes over of a due ſtrength: filter it, after it has been kept ſome days.

*Note.*

This will in all reſpects reſemble perfect ſpirit of hartſhorn, as prepared by the firſt proceſs; but if it be made of the crude ſpirit of hartſhorn, like the true ſpirit, it will be apt to turn foul and fœtid. That made with the ſpirit of bones will keep much longer; but not ſo well as the produce of the former proceſs.

However this ſubſtitution may reſemble the true kind of ſpirit of hartſhorn, or that drawn from bones, it will be inferior with regard to the medicinal qualities; becauſe, though it will appear equally replete with oil, yet it will not contain ſo great a quantity; and what it may contain will be of a groſſer, and leſs ethereal nature, as its tendency to grow fœtid, and foul, evinces; and, if kept any time, it will become nauſeous, and be apt to riſe on the ſtomach, like the genuine ſpirit of hartſhorn.

This ſpirit is, however, much leſs exceptionable than another kind too commonly impoſed on the public; which is prepared by means of quicklime, after the following manner.

*Sophiſtication*

*Sophiſtication of ſpirit of hartſhorn, by means of quicklime.*

To a gallon of crude ſpirit of hartſhorn, or bones, add one pound of quicklime, either at the firſt, or any ſubſequent rectification; draw off the ſpirit, and treat it as the genuine.

*Note.*

This is, by much, the worſt ſophiſtication of ſpirit of hartſhorn; and cannot be too much guarded againſt, by all, who are concerned in the ſale, or uſe, of this medicine. When indeed it is drawn off with a due proportion of ſtrength; and uſed only to ſmell to, its extraordinary pungency renders it very fit for the purpoſe: though this end may be equally well anſwered by volatile ſpirit of ſal Ammoniacum, which is almoſt every where to be had prepared in the ſame manner: but when this kind is drawn off only of the apparent ſtrength of the true ſpirit of hartſhorn, and impoſed, in its place, for internal uſe, it is a conſiderable fraud. For it is neceſſarily very defective, in the quantity of volatile ſalt; in which the principal efficacy of this medicine conſiſts: the end of uſing the lime being to increaſe the pungency; and make the ſpirit, drawn off, much weaker, ſeem equally ſtrong, with that impregnated with the

due proportion of volatile ſalt; and by this means, to increaſe the quantity. Which deluſion occaſions, therefore, only a part of the intended doſe to be virtually taken.

If we paid an implicit deference to the authority of the college, there would be another reaſon againſt this ſophiſtication: for they have condemned the uſe of lime with volatile ſalts, as rendering them noxiouſly acrimonious, and corroſive. But, if there were any truth in this principle, it muſt hold good, alſo, with reſpect to fixt alkaline ſalts; and yet we ſee, not only experience, but even the opinion of this great body itſelf, in the ſame work, aſſure us of the contrary. Nor does it indeed appear from facts, that there is any perfectly diſſolvable body, which can injure by its acrimony, when ſufficiently diluted.

This impoſition of the ſpirit of hartſhorn, or bones, actuated with quick-lime, inſtead of the genuine, is, however, ſuppoſed to be eaſily detectible, by the following means.

*A method uſed for detecting the ſpirit of hartſhorn ſaphiſticated with quick-lime.*

Add ſtrong ſpirit of wine to the ſuſpected ſpirit; and if it do not ſoon give the appearance of little ſparkling bodies, ſwimming in the fluid, and afterwards ſubſiding to the bottom, it may be concluded to be ſophiſticated,

phiſticated, with quicklime, provided, by the pungency, it appear to be of due ſtrength.

*Note.*

The principle, on which the above proof is grounded, is this. If ſpirit of wine be added to water, impregnate with volatile ſalts, in the proportion of good ſpirit of hartſhorn, it will deſtroy, in a certain degree, the diſſolving power of the water; and, conſequently, a part of the ſalt, before diſſolved, will ſhoot into ſmall chryſtals, which ſhew themſelves, firſt in the form of little ſparkling bodies, and afterwards in that of a ſhining powder at the bottom of the phials, or other veſſel, in which the mixture is contained. But, if the ſpirit be ſophiſticated with quick-lime, this will not happen, from two reaſons; firſt, becauſe quicklime changes in ſuch manner, the volatile ſalts, that they become ſo extremely ſoluble, the water can ſcarcely be ſaturated with them, in any proportion; or made to ſhoot them in chryſtals, tho' they abound in any quantity whatever: ſecondly, becauſe the ſpirit, ſo ſophiſticated, does not contain a ſufficient quantity of ſalts, to occaſion the chryſtallization of them from the weakning the ſoluble power of the water by the ſpirit of wine, even though their nature was not changed by the action of the quicklime. It may therefore be taken as a certain criterion, that the ſpirit is ſophiſticated

with quick-lime, if no ſuch appearance follow, the admixture of the ſpirit: but this method of trial is nevertheleſs ſo far defective, that no inference can be drawn from it, with certainty, of the ſpirit's being really genuine, notwithſtanding a very plentiful chryſtallization ſhould enſue: though it has been hitherto looked on, as equally concluſive as to that point alſo. But a method has been contrived of preparing the ſpirit in ſuch manner, that though the quantity of volatile ſalt be greatly deficient, and the appearance of due ſtrength be procured by the help of quick-lime; yet on this trial, with ſpirit of wine, the reſult will be the ſame, as in the ſpirit of hartſhorn, where no quick-lime was uſed; and the ſmall chryſtals will be produced, in ſuch abundance, as to induce the opinion of its being extraordinarily good, if this experiment were a ſufficient teſt. I have ſeen a quantity, not leſs than five hundred weight, treated in this manner, which paſſed the hands of perſons, who thought themſelves very ſkilful in matters of this kind: and I make no doubt this additional fraud would be more frequently practiſed, if known; eſpecially, as it increaſes the weight of the ſpirit at a very ſmall expence. I ſhall therefore omit the teaching the method of effecting it; and inſtead of that, give a ſure way of diſcovering where it is practiſed, and of determining, moreover, in all caſes, whether the ſpirit, when it appears of due ſtrength, be prepared with lime, or not.

*A more certain method of diſcovering, when ſpirit of hartſhorn, or other volatile ſpirit, is ſophiſticated with quick-lime.*

Mix ſtrong ſpirit of wine with the volatile ſpirit ſuſpected; and, if a chryſtalline powder be produced, let it ſubſide till the fluid can be poured off; and having put it into a ſpoon, hold it near the fire, or over the flame of a candle: if the powder exhale and diſappear, it may be concluded, that the ſpirit is not prepared with lime, but contains a due proportion of volatile ſalt; but if it remain after it has undergone, even, a gentle degree of heat, it may be taken for granted, that not only the uſe of quick-lime, but other eluſive methods have been practiſed.

*Note.*

I ſhall not explain the principles, on which this trial is founded, becauſe they will be obvious to perſons, who are any way verſed in theſe matters, and a farther elucidation would lead others into the knowledge of the art it is intended to explode. But whoever purchaſes any conſiderable quantity of ſpirit of hartſhorn,

would do well to prove it in this manner; and may be aſſured, if it appear of due ſtrength by its pungency to the noſe, and ſtand this teſt, that it is not ſophiſticated with lime; but properly replete with volatile ſalts.

### *Salt of hartſhorn.*

Let the ſalt be taken out of the receivers, after the diſtillation, or out of the retorts, after the rectification, before it be melted by the ſpirit, which will riſe afterwards; and ſublimed, firſt with an equal weight of chalk; and afterwards with a little rectified ſpirit of wine.

### *Note.*

This is the proceſs given by the college for the preparation of this medicine. The ſame may be done with reſpect to the volatile ſalt, obtained from bones, which will keep its white colour longer, and be much leſs ſubject to grow fœtid, than that extracted from horn.

The quantity of chalk, here directed, is much greater than is requiſite to abſorb the oil, and prevent its riſing with the ſalt; for which reaſon only it is added: half the quantity, or leſs, will anſwer the end equally well.

The ſpirit of wine, which is deſigned to combine with, and waſh down, the oil from the

the ſalt, does not, on experiment, anſwer the purpoſe, in a proportion equivalent to the inconvenience its elaſtic vapour, joined to that of the volatile ſalt, produces, during the whole operation, by forcing the lute: and it will be found, on trying both methods, that the ſublimation will ſucceed, on the whole, better without it.

The ſublimation of the ſalt of hartſhorn is beſt performed in a retort, with a ſmall receiver; the neck of the retort being ſhort and wide.

After the ſalt of hartſhorn, or even that of bones, have been purified, in the beſt manner they can, by repeated ſublimation, it will ſoon grow brown and fœtid, by keeping; which is a great inconvenience to thoſe who ſell it, and have not a quick demand. The following fictitious kind has been, therefore, ſubſtituted for it; being not only free from this incommodious quality of changing colour; but, alſo, prepared with much leſs trouble and expence.

*Fictitious ſalt of hartſhorn, the ſame with the genuine in all other qualities; and not ſubject to change colour, or grow fœtid.*

Take ſix pounds of the volatile ſalt of ſal Ammoniacum; add to it half a pound of chalk, mixt with two ounces of the oil taken off the ſpirit of bones, in the rectification,

cation, as directed p. 97; ſublime them together; and ſeparate the white part after the ſublimation, from that which appears brown; the latter being reſerved for another ſublimation, with a freſh quantity.

*Note.*

In making the volatile ſalt of the ſal Ammoniacum, a part of it will neceſſarily ariſe foul, as we ſhall ſee below: ſuch foul part will very well ſerve for this purpoſe.

If it be more convenient, inſtead of taking the volatile ſalt already made, to conjoin the making it, and the converting it into the ſalt of hartſhorn, into one operation, the crude ſal Ammoniacum, and proper quantity of chalk, may be uſed according to the proceſs below given: and, in this caſe, it is beſt to mix the oil with chalk into a ſtiff paſte; and, having formed the mixture into balls, to put them into the retort after the other ingredients, that they may lie out of the reach of the ſtronger heat, which would occaſion the oil to riſe before the greateſt part of the ſalt.

The ſalt, ſo prepared, is indiſtinguiſhable from the genuine ſalt of hartſhorn, by any other means, than keeping it till the continuance of its white colour ſhall ſhew the difference: and, notwithſtanding, I have given it the name of fictitious, it is in reality the ſame, with the ſalt obtained

tained by the regular proceſs; except that the oil is of a purer, and more ethereal nature, than what is found in the other: on which account, this is certainly preferable, for other reaſons, as well as its maintaining its whiteneſs, and not becoming fœtid. Since, if we allow all volatile alkaline ſalts, to be the ſame, this muſt appear a better medicine, from the qualities of the oil it contains; and recommends itſelf ſtill further by being of a much more cheap and eaſy preparation than the genuine.

### *Calcined hartſhorn.*

Let pieces of hartſhorn, or the coal which comes out of the pot after the diſtillation of the ſpirit of hartſhorn, be burnt in an open fire, till they become perfectly white: and, then, let them be levigated as other earthy, or teſtaceous bodies.

### *Note.*

The college of London have directed this to be done in a potters furnace: and for thoſe, who have not occaſion to calcine ſuch quantities, as may anſwer the expence of a proper furnace in their own elaboratory, the ſending the materials to the potters, tobacco-pipe-makers, or other ſuch perſons, who have very ſtrong fires for other purpoſes, will be the cheapeſt and eaſieſt method.

### *Fictitious calcined hartſhorn.*

Let the coal of the bones, which remains, in the pot, after the extraction of the volatile ſpirit from them, be treated in the ſame manner as that of hartſhorn.

### *Note.*

This ſubſtitution is very frequently practiſed; and, if the bones be perfectly calcined, the earth will be indiſtinguiſhable from that of the hartſhorn: being in fact abſolutely the ſame ſubſtance. This, therefore, is a fraud productive of very little miſchief; and may be permitted where any ſuch are allowed.

It is, however, much more difficult, from their texture, to give the bones a perfect calcination than the horn: and it is, therefore, proper to break the coal of them, which is uſed for this purpoſe, into very ſmall bits; which much facilitates the operation.

### *Volatile ſalt of ſal Ammoniacum.*

Take of the pureſt chalk, two pounds, ſal Ammoniacum one pound, ſublime them in a retort, with a ſtrong fire.

*Note.*

*Note.*

This is the proceſs of the London-college, and the common practice: but the quantity of chalk is much too great; filling the retort unneceſſarily, and adding, in ſome degree, to the foulneſs of the ſalt; if the chalk, as happens very frequently, contain any impurities. The following is therefore a much better proportion of the ingredients: and the directions below given for the conduct of the operation, if obſerved, will produce a whiter ſalt, and with much leſs expence and trouble, than the methods commonly practiſed.

*Improved proceſs, for the making the volatile ſalt of ſal Ammoniacum.*

Take the whiteſt ſal Ammoniacum, dry it well while in large pieces, and pick out from it, and ſcrape off every part, which appears the leaſt diſcoloured. Then take the cleaneſt chalk; and dry it thoroughly, by heating it as hot as boiling water, but not hotter: powder it well, and dry it again: mix the ſal Ammoniacum and the chalk, while both are in this dry ſtate, in the proportion of five parts of chalk, to four of the

the ſal Ammoniacum: put them into a retort, with a thick ſhort neck, and the orifice cut very wide: fit to it a ſmall receiver, with a long neck; and lute them well together. Then put them into a ſand-pot; and ſublime the ſalt, very gradually; never ſuffering the lower part of the receiver to grow very hot. Let the fire, however, be raiſed to a ſtrong heat at the latter part of the operation. When the retort and receiver are grown cold, break the receiver, and ſeparate ſo much of the ſalt as appears white and pure, from the diſcoloured; and breaking it into lumps, preſerve it carefully from exhaling, which will dull the tranſparent appearance. The leſs ſightly, and foul, parts, may be uſed for the making the ſpiritus volatilis oleoſus; or fictitious ſalt of hartſhorn; or purified by reſublimation, if that be more convenient.

*Note.*

By this method of diminiſhing the quantity of chalk, uſing only ſuch ſal Ammoniacum as is clean, and employing a ſmall receiver, the neceſſity of a ſecond ſublimation is taken away:

away: for the purity of the ſal Ammoniacum will occaſion a conſiderable quantity of the volatile ſalt to be pure alſo: and render the retorts capable of ſubliming a greater quantity of the ſalt, by diminiſhing the quantity of chalk; and the uſing at the ſame time a ſmall receiver, will cauſe the cake of the ſublimed ſalts to be of a due thickneſs; which it otherwiſe cannot be made, without putting the produce of two or three of theſe operations together, and ſubliming afreſh.

The ſcrapings, or foul parts, picked out of the ſal Ammoniacum, need not, in the leaſt, inhance the expence: for they may be uſed, for making the volatile ſpirits, or any other ſuch purpoſe: neither will the foul parts of the ſublimed volatile ſalt be in the leaſt a loſs, for they may be very profitably employed alſo, for the purpoſes abovementioned.

Great care ſhould be taken, if the powdered chalk and ſal Ammoniacum be kept after they are reduced to that ſtate, either together, or ſeparately, not to ſuffer the air to have any acceſs to them: for they will immediately attract moiſture, which is very detrimental to this operation; as a very ſmall quantity is apt to melt down the ſalt from the ſides of the receiver into the bottom, and diminiſh the thickneſs of the ſublimed cake, on which the produce of the ſaleable ſalt depends.

Much caution ſhould be likewiſe uſed, in the management of the fire: for, if it be precipitated, not only a great riſque is run of burſting

ing the retort, or receiver; but, the ſalt, being in too hot a ſtate, to form on the ſides, will flow down to the bottom of the receiver, and produce the diſadvantage before mentioned.

A cake of crude ſal Ammoniacum will ſometimes be found on the top of the chalk, after the ſublimation; as likewiſe in the neck of the retort. This may be alſo uſed for making the volatile ſpirit, and the ſal Ammoniacum, as the being mixt with the chalk will not in the leaſt injure it for that purpoſe.

### *Volatile ſpirit of ſal Ammoniacum with fixt alkaline ſalt.*

Take of any fixt alkaline ſalt, one pound and half, ſal Ammoniacum, one pound, water, four pints: with a gentle fire, diſtill off two pints.

#### *Note.*

This is the proceſs of the London-College; in which the quantities ſeem very ill adjuſted: for one pound of dry pure, fixt, alkaline ſalt is more than ſufficient, to diſpoſſeſs the volatile ſalt of the ſal Ammoniacum of its acid ſpirit. The quantity of fluid drawn off is likewiſe very ſmall, in proportion to the quantity of ſalt: for volatile ſpirit is extremely ſtrong, when one fourth part of it is ſalt. This ſalt may

may be prepared genuinly, and at a moderate expence, in the following manner.

*Cheaper method of preparing the volatile ſpirit of ſal Ammoniacum with fixt alkaline ſalt.*

Take of ſal Ammoniacum, and pearl aſhes, equal parts; add to them about five times their weight of water; put them into the tin alembic deſcribed p. 40; and fix two receivers to the two arms; place it in the ſand-bath; and diſtill off the ſpirit, while it continues to come off ſtrong: when it appears weaker, change the receivers, and draw off the remainder ſo long as the fluid partakes of any ſmell of the volatile ſalts. Put by the ſtrong for uſe; keeping the weak, to be added to the water in the next operation, of the ſame kind; or uſe it along with other volatile ſpirit, or ſalt, in the making the ſpiritus volatilis aromaticus; or for any ſuch purpoſe.

*Note.*

The ſcrapings of the ſal Ammoniacum, deſigned for the volatile ſalt, may be employed for this purpoſe: or the foul part of the vola-

tile ſalt itſelf, diſſolved, may be added to this ſpirit, when there is any convenience in ſo doing; but the ſolution muſt be firſt filtered, if it appear in the leaſt turbid.

The uſe of pearl aſhes, inſtead of ſalt of tartar, which is directed by the Edinburg-college, or indeed of any other fixt alkaline ſalt, at preſent in uſe, is an obvious ſaving; and comes within the latitude given by the college of London.

This ſpirit, however, is almoſt wholly excluded practice, by the uſe of that, made with quick-lime, notwithſtanding the college of London have endeavoured, to prohibit the uſe of volatile ſpirit made with lime, on account of its ſuppoſed acrimony; as was before mentioned. But the much greater pungency of the kind with lime, which renders it much fitter for the purpoſe of ſmelling to, on which account a great part of the demand is made, together with the inconvenience of keeping another kind for other uſes, occaſions it to be almoſt univerſally ſold, inſtead of that with alkaline ſalt, by the wholeſale preparers and dealers in medicine, to the apothecaries and retailers: and it is, therefore, proper to inquire into the beſt method of preparing it; eſpecially as one particular medicine, the college themſelves have given a place to in their laſt pharmacopæia, cannot be prepared without it; I mean volatile tincture of the bark, which, in the ſpirit made with fixt alkaline ſalt, becomes only a mucilage.

*Volatile*

*Volatile ſpirit of ſal Ammoniacum made with quicklime.*

Take of ſal Ammoniacum, in fine powder, one pound, of quicklime, which has laid in the air till it be broken to powder, two pounds; mix them well, and put them preſently into a retort, with two pounds of water: ſhake them, to mix the powder and water; and place the retort in a ſand-heat; diſtill off about twelve ounces: but, the receiver being changed, about four ounces of weaker may be alſo drawn off.

*Note.*

This is the former proceſs, uſed for the preparations of this ſpirit; but it is faulty in ſeveral reſpects.

The expoſing the lime to the air, is ſo far from neceſſary, as to be very injurious to the qualities, by which it operates in this proceſs: the quantity, alſo, of the lime, is much greater than needful; both filling the retorts with needleſs matter, ſo as to render the produce of the operation leſs, by even two thirds, than it may be by a better proportion of the quantities; to the great increaſe of the expence and trouble; and cauſing them, likewiſe, frequently to break

during the operation; to the loſs of half, or more, of the ſpirit.

The powdering the ſal Ammoniacum, or making any previous mixture of it with the lime, before they are put into the retort, is likewiſe wholly needleſs; for the ſalt will of courſe melt in the fluid as the warmth increaſes.

The quantity of water is likewiſe much too ſmall: for at leaſt twice the weight of the ſalt may be drawn off; according to the proportion of the college in the ſpirit with ſalt of tartar; and, as it is impracticable to draw off the whole fluid, (becauſe the retort will crack, when the lime attains a certain degree of dryneſs,) that quantity of ſpirit cannot be obtained with this ſcanty proportion of water.

The following method, therefore, is much better; amending theſe ſeveral errors; and accommodating the materials to each other in due proportion.

*Improved method of making the volatile ſpirit of ſal Ammoniacum with quicklime.*

Take of ſal Ammoniacum four pounds, quicklime five pounds, water three gallons. Quench the lime in part of the water, and then put it into the pewter alembic for making this ſpirit, deſcribed p. 40: add

to

to it the ſal Ammoniacum, and water; and place the retort in the ſand-bath: where diſtill off ten or twelve pounds, and then change the receiver; ſuffering, afterwards, the ſpirit to diſtill, while any pungency remains: this weaker ſpirit muſt be added, to the materials in ſome future operation, in the place of ſo much water.

*Note.*

By this diminution of the quantity of lime, a retort will, at one operation, diſtill at leaſt three times as much ſpirit, as in the former proceſs: and will frequently ſerve a ſecond time for the ſame purpoſes; which can never happen when more lime is uſed.

It is uſual to draw off four or five times the weight of the ſal Ammoniacum; and the ſpirit will, even then, appear extremely ſtrong: but, whoever would have this ſpirit correſpondent to that of the college, made with fixt alkaline ſalt, muſt only draw it off in the proportion of three times the weight.

The uſe of quicklime, in making the volatile ſpirit of ſal Ammoniacum, may be detected by the ſame trial of it, by means of ſpirit of wine, as has been given for the ſpirit of hartſhorn: but as the common trial is ſubject likewiſe to the ſame eluſion, as was before mentioned, the further means, before given,

of aſcertaining the nature of the chryſtals, produced on the addition of the ſpirit of wine, ought alſo to be uſed.

## *Spiritus ſalis Ammoniaci dulcis ; or dulcified ſpirit of ſal Ammoniacum.*

Take of any fixt alkaline ſalt half a pound, ſal Ammoniacum four ounces, proof ſpirit three pints: diſtill with a gentle heat, till a pint and a half be come over.

### *Note.*

The proportion of the fixt alkaline ſalt to the ſal Ammoniacum is here, as before in the old proceſs for the volatile ſpirit, double what it needs to be: the quantity of proof ſpirit is likewiſe improper; for either, out of the three pints employed, half the quantity of real ſpirit muſt be left behind; or the ſpirit, which comes over, will contain much too little water, to keep diſſolved the quantity of volatile ſalt produced: for, in order to have three ounces diſſolved in a pint and half of ſpirit of wine, the ſpirit ought not to be ſtronger than proof ſpirit. But, as in fact, this proceſs, ſo far as regards the addition of the ſpirit of wine, produces nothing more than a bare mixture of the ſolution of the volatile alkaline ſalt, and the ſpirit, (except the rectification of the latter) it may properly be rejected;

and the following ſimpler manner ſubſtituted, in its place, for obtaining the ſame compoſition.

*Extemporaneous dulcified ſpirit of ſal Ammoniacum.*

Take of ſpirit of ſal Ammoniacum, made with fixt alkaline ſalt, one pound: add to it rectified ſpirit of wine half a pound; and ſhake them well together.

*Note.*

This will be, in all reſpects, the ſame with the other; and may be made, occaſionally, without the trouble of a diſtinct proceſs: but, if the ſpirit be wanted, free from the appearance of ſalt, which will be found in this mixture, as well as in the ſpirit produced by the proceſs of the college of London above given, water muſt be gradually added, till the ſalt be diſſolved; taking care, not to put in more than may be ſufficient to that end.

*Spiritus volatilis aromaticus, or ſal volatile oleoſum.*

Take of the eſſence of lemons, and eſſential oil of nutmegs, each two drams, of the eſſential oil of cloves, half a dram, dulcified

ſpirit of ſal Ammoniacum, two pints; diſtill them, with a ſlow fire.

*Note.*

This is a very good and elegant compoſition: but the uſe of volatile ſpirit, with the proper proportion of ſpirit of wine, will equally well anſwer the end; and ſpare the proceſs for the making the dulcified ſpirit.

In this proceſs, which is that of the college of London, it is intended, that a part of the diſſolved ſalt ſhould remain in the ſpirit; in order to ſhew, that the ſpirit contains the proper quantity of ſalt; and that, it is not prepared with quicklime; but this is really no certain teſt of either: for there may be a falſe appearance of volatile ſalt, given by the means above hinted at, as well in this caſe as in thoſe of the ſpirit of hartſhorn, and volatile ſpirit of ſal Ammoniacum; which ſhould, therefore, be explored, by the method above given, where there is any ground for ſuſpicion of ſuch a fraud; as I have more than once ſeen this ſophiſtication actually practiſed.

The ſpiritus volatilis aromaticus may, however, be prepared by a cheaper method than this proceſs; preſerving both the ſame ſenſible and medicinal qualities.

*A cheaper method of making the ſpiritus volatilis aromaticus, reſembling that of the college of London, and equally good with reſpect to the intention.*

Take of the volatile ſalt of ſal Ammoniacum, made with chalk, two pounds, or the volatile ſpirit, made with fixt alkaline ſalt, of the full ſtrength, ſix pounds; (if the ſalt, and not the ſpirit, be uſed, three pints of water muſt be added;) put the ſpirit, or diſſolved ſalt, into a retort, together with eight pounds of proof ſpirit, half a pound of pimento or Jamaica pepper, two ounces of caſſia lignea, and one ounce of eſſence of lemons: place the retort in the back part of the ſand-bath; and diſtill off the ſpirit and ſalt till there be a cloudineſs in the drops; then change the receiver, and draw off the remaining fluid while it appears to have any ſmell or flavour: this weaker ſpirit muſt be added to the materials with the next quantity made.

*Note.*

*Note.*

The aromatic ſpirit, thus prepared, will be equally good with that of the college; and may be made with much leſs trouble, and expence; if the foul part of the volatile ſal Ammoniacum be employed for it.

But it is very frequent, to ſubſtitute in the place of theſe kinds, what is prepared by means of lime: and the greater pungency which the lime gives to the volatile ſalt in this ſort, often impoſes even on apothecaries, not greatly verſed in the preparation of chemical medicines; and makes them believe it to be good. Where there is no undiſſolved ſalt in it, the diſtinguiſhing this kind, from that properly prepared, requires a new method of proof; for the mixing ſpirit of wine, which avails with regard to the other volatile ſpirits, is here evidently of no uſe. The following trial ſhould, therefore, be made in this caſe, where the ſophiſtication by lime is ſuſpected, and the ſpirit is found very pungent to the noſe.

*Method of diſtinguiſhing when the ſpiritus volatilis aromaticus is made with lime, in the caſes where there is no undiſſolved ſalt with it, and the ſpirit is yet found extremely pungent.*

Take a ſmall quantity of the volatile ſal Ammoniacum, powdered, and put it gradually

dually into a phial, containing the ſpiritus volatilis aromaticus, which is to be proved: ſhake them well together; and if the ſpirit, notwithſtanding its great pungency, ſenſibly diſſolve the ſalt, it may be taken for granted, that it was made with lime; but if the ſalt remain intirely undiſſolved, or be diſſolved but in a ſmall degree, the contrary may be, with certainty, concluded.

## SECTION II.

### *Of the preparation of thoſe medicines, where vegetable ſubſtances make the whole, or principal part of the ſubject.*

#### *Salt of wormwood.*

Take any quantity of wormwood, either freſh gathered, or dried gently; put it into an iron pot; and, with a gentle fire, reduce it to white aſhes; which are afterwards to be boiled in a ſufficient quantity of ſpring water, ſo as to make a lye: filter the lye, and

and exhale it, over a gentle fire, till a brown ſalt be left behind; which, by repeated ſolutions, filtrations, and evaporations, may be rendered white and pure.

*Note.*

The incineration, or burning, may be better performed, upon a clean hearth, in ſome place where the wind cannot blow away the aſhes: and the repeated means of purification are needleſs, not only becauſe they would fail to render the ſalt more pure than the firſt filtration alone, (provided it be performed through paper); but, becauſe, if they did produce a purity, and whiteneſs, in the ſalt, they would render it unmarketable; as being wholly undiſtinguiſhable from ſalt of tartar.

This ſalt does not differ from the fixt alkaline ſalt, obtained from any other vegetable, by the ſame means; nor from ſalt of tartar; except that in the preparation of the laſt, a greater calcination being made, the burnt oil is deſtroyed, which gives to the ſalt of wormwood its brown colour.

It is very uſual, therefore, to ſubſtitute the ſalt of other vegetables, for that of wormwood; there being no medicinal difference betwixt them, as we have before obſerved; as both the fixed ſalts and burnt oils of all vegetables are, when pure, alike in their qualities: but a fictitious ſalt may be made from pure fixt alkaline

alkaline ſalt, exactly the ſame with the ſalt really obtained from wormwood, by the above proceſs, if the following means be uſed.

*Fictitious ſalt of wormwood, not differing, in any reſpect, from the genuine, but with regard to its production.*

Take a little wormwood, and reduce it to the ſtate of an imperfect charcoal, by burning it in a crucible, covered from the air; it muſt not nevertheleſs be burnt till the flaming quality be deſtroyed, but taken from the fire as ſoon as it is perfectly black. Put ſome of this coal, together with a pound of pearl aſhes, into four pints of water, and boil them together: let them ſtand till they are cool, and then filter through paper, and evaporate to a dry ſalt; to which the burnt oil of the coal will have imparted a proper degree of brownneſs; that, if too great, muſt be adjuſted by the addition of more pearl aſhes purified by the filter.

*Note.*

This contains unqueſtionably the ſame elements, as the true ſalt of wormwood: ſince the oil, in which alone, there can be poſſibly

ſuppoſed

ſuppoſed any difference, is here the ſame as in that.

This ſubſtitution may, therefore, be well allowed, in any view: and, with reſpect to the medicinal effects, the ſubſtitution of ſalt of tartar, or any other fixt alkaline ſalt, for the ſalt of wormwood, cannot be condemned on any maintainable principles, as any way injurious, or inſufficient to the intention of cure; according to what we have before ſhewn.

### *Salt of tartar.*

Let crude tartar of either kind, folded up in wet brown paper, or contained in a proper veſſel, be put into the fire, and continued there, till all the oil be burnt out: the ſalt is then to be procured from it, by ſolution in boiling water; with a ſubſequent evaporation, after having been filtered thro' paper.

If the ſalt be required of a more ſaponaceous and pungent nature, let it be fuſed, in a crucible, for ſome hours, with a very hot fire, till it acquire a greeniſh, or blue colour.

### *Note.*

Salt of tartar was alſo formerly made by deflagrating nitre and tartar: which may be done, by

by powdering them together, in the proportion of two parts of tartar to one of nitre; and then putting the powder, gradually, by a ſpoonful at a time, into a crucible, heated red hot; which muſt be kept in the fire during the operation, and for ſome time after: The ſalt, being thus duly calcined, muſt be diſſolved, and purified, as in the other proceſſes, by filtering. But all theſe methods are greatly diſuſed at preſent; the wholeſale dealers having learnt the ſecret of preparing a fixt alkaline ſalt, by the following much more profitable method, which is now for the moſt part uſed in the place of ſalt of tartar.

### *Fictitious ſalt of tartar.*

Take of the beſt pearl aſhes, any quantity; diſſolve them in boiling water, in the proportion of a pound to a quart; when they are diſſolved, let the ſolution ſtand till it be cold; and then filter it through paper: being filtered, evaporate the fluid, till a dry ſalt remain; which, being broken into a groſs powder, muſt be put into a proper bottle of glaſs or ſtone, and kept carefully from the air.

The evaporation may be performed in a clean iron pot; but not in an earthen pipkin;

kin; and the greateſt care ſhould be taken neither to let the ſolution, or ſalt, be put into copper, or braſs veſſels, on any account.

*Note.*

This, according to the principles before laid down, is, in all reſpects, the ſame as ſalt of tartar: and fixt alkaline ſalt being a medicine, which both uſed ſimply, and in the febrifuge draughts, is of the higheſt efficacy, and conſumed in very great quantity: the ſubſtitution of this cheaper kind for the ſalt of tartar, which cannot be prepared without much greater coſt and trouble, is rather a benefit to the public, than a detrimental fraud.

The neglect of the caution, above given, of avoiding the uſe of braſs or copper utenſils, in the preparation of ſalt of tartar, or this ſubſtitute, frequently occaſions it to be very noxious: for by powdering it in braſs mortars, from which it immediately collects all the ruſt, or indeed makes itſelf a corroſion if there be the leaſt moiſture, an emetic quality is acquired; which affecting thoſe, who take the ſalt in any form, induce them to believe the medicine itſelf diſagrees with them, from its own nature.

The pearl aſhes are frequently adulterated greatly with ſea ſalt; but this may be perceived by the taſte if a ſmall quantity be diſſolved, for that purpoſe: and though, perhaps, they cannot be eaſily procured in a pure ſtate, yet if

if the ſolution be made in the proportion above directed for the water and ſalt, the greateſt part of the ſea ſalt will chryſtallize, on the fluids being ſuffered to cool before it be filtered; and by this, a ſeparation of the greateſt part will be made; and the remaining ſmall part will not deprave the fixt alkaline ſalt, for any medicinal purpoſe.

### *Oil of tartar per deliquium.*

Take any quantity of ſalt of tartar, highly calcined: put it, in any ſtone, or glaſs, veſſel, of a flat form, into a cellar, or any moiſt place: where let it ſtand, for ſeveral days, till the ſalt be diſſolved, by the humidity of the air; then filter it through paper; or ſeparate the fluid from the dregs by decantation.

### *Note.*

As this is no way different from any other ſolution of the ſalt, of equal ſtrength; or, as, if any change be produced by this method of ſolution, it can be only a depravity of the alkaline quality by the acid of the air, this proceſs is needleſs: and, therefore, the following extemporaneous method of making this deliquium, is uſed inſtead of it.

*Extemporaneous method of making oil of tartar per deliquium.*

Take of fictitious ſalt of tartar, above-mentioned, any quantity: diſſolve it, by boiling, in half its weight of water; and filter the ſolution when cold.

If any ſalt precipitate to the bottom of the veſſel, in the cooling of the ſolution, or be found in the filter, it may be ſaved; and put to the pearl aſhes, when the fictitious ſalt of tartar is to be made from them; or uſed for any ſuch other purpoſe.

*Note.*

This is a much more expeditious and commodious method, than the tedious manner of diſſolving the ſalt, by the moiſture of the air: which does it ſo imperfectly, that a great waſte generally accrues.

*Soluble tartar.*

Take, of any fixt alkaline ſalt, one pound, of water, one gallon: to the ſalt, diſſolved in the water boiling, throw in cream of tartar, gradually, till the effervescence, that before aroſe

aroſe on each addition, ceaſe to appear; which will be, when, or before, three times the weight of alkaline ſalt has been thrown into it: then filter the ſolution through paper; and, after a proper evaporation, let it be ſet to ſhoot into chryſtals; or otherwiſe make a total exhalation of the water, that the ſalt may remain in a ſolid maſs.

*Note.*

As there is no neceſſity of a boiling heat, for the combination of the cream, and ſalt, of tartar, into the ſoluble tartar; and, as this medicine is never given in a dry form; it has been a practice with ſome, to ſpare all parts of this proceſs, but the powdering the ingredients; and to ſubſtitute the following ſimple preparation, in the place of the other.

*Extemporaneous ſoluble tartar.*

Take of any fixt alkaline ſalt, three pounds, of cream of tartar, one pound: powder, and mix them thoroughly together.

*Note.*

This will, on diſſolving in any fluid, previouſly to its being taken, become exactly the ſame,

as if it had paſſed through the other omitted parts of the above proceſs; and cannot, therefore, be deemed a ſubſtitution of a very criminal nature.

In the preparation of this, it is proper to obſerve, ſtrictly, the ſame caution, as in the caſe of the ſalt of tartar, with regard to copper or braſs veſſels.

*Sal polychreſtum ſolubile; or, ſelle de Seignette.*

Take of the aſhes of the kali of Alicant any quantity, extract the ſalt according to art: and calcine it in a crucible, with a ſtrong heat, that it may be freed from ſulphur; and afterwards form it into chryſtals.

Take, of the chryſtals of the ſalt of the kali, twenty ounces; diſſolve it in four pints of water; add to it four pounds of cream of tartar, or ſufficient to neutralize it: filter the ſolution, and ſet it by; that the ſalt may ſhoot into chryſtals.

*Note.*

This is the proceſs of the pharmacopæia of the faculty of Paris, for the making the ſelle de Seignette; which has lately been introduced into practice here; prepared by the apothecary's company; and preſcribed by ſome eminent perſons;

ſons; under the newfangled names of ſelle de Seignette, or ſal Rupilienſe: though it is obvious, on the peruſal of the proceſs, even to thoſe who are but the leaſt acquainted with matters of this kind, that it is no way different from the tartarum ſolubile, long known here; and given in ſeveral ſucceſſive editions of the pharmacopæia of the college, and moſt other modern books, which treat of the preparations of medicines.

Nor does, indeed, the proceſs itſelf, for the ſelle de Seignette, differ in any circumſtance, even of form, from thoſe given for the ſoluble tartar; except, in directing a previous preparation of the fixt alkaline ſalt, to be made from the kali of Alicant; which ſalt, when calcined, as there directed, to free it from the burnt oil, will be no way different, (according to the principles we have before laid down,) from any other fixt alkaline ſalt calcined to perfect purity: and were, indeed, the ſalt of the kali of Alicant, ſuperior, in any qualities, to other fixt alkaline ſalts, ſo as to give ſome foundation, for diſtinguiſhing the ſoluble tartar, prepared from it, by a peculiar name, could the preſcribers of it here expect, or the preparers pretend, that it is fetched from Spain for this purpoſe: but that ſalt of tartar, or ſome other fixt alkaline ſalt is uſed inſtead of it. They may, indeed, ſay, that we have a Spaniſh ſalt here under the name of Barillas, that is the ſame with the ſalt of the kali; and they may equally well ſay the ſame of the Ruſſian pearl aſhes, or any

other fixt alkaline ſalt prepared in the ſame way.

There is, indeed, a particularity practiſed in the preparation of the ſalt of kali, here directed, (which is the forming it into chryſtals) that is never done in the caſe of other fixt alkaline ſalts: but this can no way make any difference in the compoſition of this medicine, being only an accidental form, or configuration, of maſſes of the ſalt, and no variation of its abſolute nature: and, indeed, the reaſon why the chryſtallization of fixt alkaline ſalts is wholly neglected, is owing to its being not in the leaſt neceſſary, or conducive to any one end, or purpoſe, to which theſe ſalts are applied in medicine.

Wherever, therefore, ſelle de Seignette is preſcribed or demanded, the ſoluble tartar, prepared according to the proceſſes above given for it, may be adminiſtered or ſold; as it is in fact the ſame: only, to ſupport the due appearance, it is neceſſary, that it ſhould be ſhot into chryſtals; and not evaporated, as uſually, into a dry maſs: chryſtals being the form which the Pariſian diſpenſatory directs.

*Of cremor tartaris, or cream of tartar.*

Let the crude tartar be powdered, and diſſolved, in ſixteen or eighteen times its weight of water in the boiler, which is deſcribed p. 34 as part of the apparatus for making

making this ſalt: let the heat be then checked, that the fluid may ceaſe to boil; and after it has ſtood at reſt, in a heat near that of boiling; but leſs than will produce any ebullition, till it become clear by the ſubſiding of the feces, turn the cock of the pipes, which makes the communication betwixt this boiler and the cylinders; (deſcribed as a part of the apparatus); and, when the cylinder is filled with the ſolution, turn again the cock, and ſtop the communication; let the fluid then remain in the cylinders, till the chryſtals be formed at the bottom and ſides; and then return back the mothers into the boiler; and add a freſh proportion of crude tartar; repeating the ſame operation till a conſiderable quantity of chryſtals are cruſted on the cylinder: but, if the fluid, on returning it into the boiler, appear to abound in feces or foulneſs, paſs it through a large flannel bag; and add, if neceſſary, a freſh quantity of water, as well as crude tartar, to ſupply what is conſumed in the boiling: when a ſufficient quantity of chryſtals are formed in the cy-

linder, they must be taken out into baskets; and, the fluid being drained off, they must be dried for use: the cake of chrystals at the bottom of the cylinder, which will generally prove foul from the sediment, must, if found so, be returned into the boiler along with the crude tartar.

*Note.*

By this method, a great quantity of the salt may be purified, and chrystallized; which, by common methods, is impracticable; as it requires so very large a proportion of water, for the dissolving it; and, consequently, becomes much too voluminous to be managed in glass vessels, as other salts.

It has been said, that the common preparation of cream of tartar, which is in the hands of a very few persons, is not a purification and chrystallization only; but an adulteration, by means of white earth added to it in the solution. But I think the contrary of this is evident, from the qualities of the salt, as we generally find it: for, allowing that there were a redundant portion of a unneutralized acid, in the crude tartar, and that, such acid combining with this white earth, another species of salt might be formed, together with the chrystals of the tartar; yet this earth would become apparent on the admixture of fixt alkaline salt in the

the preparation of the tartar ſolubilis; or on any other occaſion: as it would be then neceſſarily precipitated; and render the fluid white and turbid, while in an agitated ſtate, ſettling afterwards in the form of a powder. Now, this appearance not being found to happen, we may certainly conclude, that there is no adulteration of this ſalt by means of any earth; ſince the power of fixt alkaline ſalt, which precipitates the earth, from all neutral ſalts, of which it is the baſis, is a ſure teſt, in this, and all other caſes, where it may come in queſtion, whether ſuch ſalts be formed of earth, or not.

### *Vitriolated tartar.*

Take, of green vitriol, eight ounces, of water, four ounces; throw ſalt of tartar, or any other fixt alkaline ſalt, to the vitriol, diſſolved in the water boiling, till all ebullition ceaſe; which will be, when four ounces, or ſomething more, of the ſalt has been uſed: then filter through paper; and, after due evaporation, let the fluid ſtand, that the ſalts may ſhoot.

### *Note.*

Vitriolated tartar is, with much more convenience, made from oil of vitriol, than from the crude vitriol: ſince, as the only reaſon, for the

the preference of the vitriol to the oil, muſt be the ſaving made in the price, even that will ſcarcely hold good, when all things are conſidered: and, as the large quantity of oker, precipitated from the vitriol, retains, unavoidably, a conſiderable quantity of the ſolution, in the filter; and, conſequently, occaſions a proportionable waſte of the vitriolated tartar. But, if there really was a ſaving in the expence of the materials, it would not countervail the trouble and depravity of the ſalt, which are apt to attend on this method of making it: for, if the operation be not conducted with the greateſt care, and even ſome good luck, a diſagreeable ochrous flavour, and brown colour, will be found in the ſalt produced: from which, indeed, it is ſcarcely poſſible to keep it free, when prepared from crude vitriol.

It is, therefore, much better to uſe the oil of vitriol inſtead of the ſalt; and, in that caſe, the proceſs may be the ſame in all other reſpects.

It is almoſt an univerſal practice, to ſubſtitute, in the place of the vitriolate tartar, thus prepared regularly, the caput mortuum taken out of the retorts after the diſtillation of ſpirit of nitre, prepared from oil of vitriol; and as this is done, without any other preparation than powdering, the ſalt, generally contains a conſiderable quantity of oil of vitriol, which the fire has not been powerful enough to raiſe in the diſtillation as commonly managed; and is, therefore, though in other reſpects the ſame with the vitriolated tartar prepared in the manner

manner above directed, very unfit to be uſed, in the caſes, where this medicine is moſt ſerviceable; as a doſe, ſufficient to act in the cathartic intention, will ſometimes contain much more oil of vitriol, than ſhould, at any time, be given; whereas, moreover, on this occaſion, any quantity is improper. This ſubſtitution, however, with due preparation, may be very well allowed; for, on being duly neutralized, and formed into chryſtals, this ſalt differs, in no reſpects, from that prepared by the moſt regular method, and it may be, therefore, thus managed.

*Manner of preparing vitriolated tartar from the caput mortuum, remaining after the diſtillation of aqua fortis by Glauber's method.*

Take, of the caput mortuum, any quantity; diſſolve it in water boiling; and add to it, pearl aſhes, in the proportion of one ounce to every pound; or two ounces, if the caput mortuum appear very acid to the taſte: filter the ſolution; and chryſtallize the ſalt.

*Note.*

By this method, this moſt valuable medicine, for which hereafter there will probably be a very conſiderable demand, may be made extremely

extremely cheap, and perfectly good. At preſent, the depraved ſtate, in which it is ſold, prevents its being preſcribed under this name: and, indeed, this abſurd ſubſtitution has ſo far prevailed; that the acid taſte, and the form of a powder, are looked upon as eſſential qualities, in the ſhops. But, whoever would have the vitriolated tartar, in a perfect ſtate, muſt aſk for it under the name of ſal polychreſt; which, though directed, in diſpenſatories, to be prepared by different means, is yet the ſame ſubſtance, in every reſpect, as was before ſhewn. It is, likewiſe, always adviſeable to inſiſt on having this ſalt in the form of chryſtals, and not powdered; to prevent the impoſition abovementioned; or others which may be attempted.

The chryſtals of this ſalt reſemble greatly to the ſprigs of chryſtal ſtone, but of a leſs length, by which appearance, they may be eaſily known from the ſal catharticum, or any other.

### *Diſtilled vinegar.*

Let vinegar be diſtilled, with a gentle heat, as long as it will riſe without any empyreumatic ſmell.

### *Note.*

This is the direction of the college, with reſpect to this preparation; and, I think, it may

may be eſteemed unfortunately defective; as the not dictating in what kind of veſſels the diſtillation ſhould be made, has given countenance to a practice, which both before, and ſince, has greatly prevailed, of performing this operation in the worm ſtill. Now the worm being in general made of bad pewter; in the compoſition of which, lead has the greateſt part, the vinegar, by paſſing through ſo long a tube of this metal, of which it is a ſtrong menſtruum, cannot fail to diſſolve a conſiderable quantity. The college of Edinburg have ſeemed properly appriſed of this inconvenience, for they order the alembics, for this uſe, to have glaſs heads. What the ill effects of ſugar of lead, internally taken, may be, I ſhall not particularize here, as they are the ſame with thoſe, ſo frequently ſeen in perſons, who work with lead: but that this bad practice may be detected, and the uſe of vinegar, thus depraved, avoided by thoſe who are duly cautious, I offer the following infallible method of diſcovering, where the vinegar is impregnated with lead in any material quantity.

*Method of diſcovering, where vinegar is depraved with lead, by diſtillation with a worm.*

Take ſome of the vinegar queſtioned, and add to it a ſmall quantity of the ſolu-

tion

tion of any pure fixt alkaline ſalt: if a cloudineſs, or milky turbidneſs, enſue, and a white powder be afterwards precipitated, it may be concluded, the vinegar contains diſſolved lead; but, if the fluids retain the ſame clearneſs and tranſparency, after their commixture, which they had before, the contrary may be, with certainty, inferred.

*Note.*

This will be a certain teſt of the purity of the vinegar, with regard to lead; as the fixt alkaline ſalt has the certain power of precipitating even the leaſt quantity; which muſt become viſible, unleſs immaterially ſmall.

In order, however, to take away this temptation, to the uſe of the worm, which the ſlowneſs of this operation, when performed in glaſs veſſels, gives, I ſhall recommend the following method.

*Compendious method of diſtilling vinegar.*

Let the operation be performed in the alembic deſcribed p. 43; which ſhould be placed in the warmeſt part of the ſand-bath; and, in the latter part of the operation, the ſand ſhould be raiſed round the alembic, that

that the upper part of it may be as much heated as poſſible.

*Note.*

By this method, not only a much greater quantity may be diſtilled at one operation, from the increaſed magnitude of the alembic, than the uſe of retorts admits of; but, by raiſing the ſand near to the height of the arm, the vapour of the heavier part of the vinegar, which is with difficulty brought over the helm, may be prevented from being condenſed on the ſides of the alembic, and remaining in the body of it after the operation.

*Diſtillation of oil of turpentine.*

Let the oil be diſtilled from the turpentine, in a proper alembic; water being added to it: the caput mortuum, left behind, will be white reſin.

*Note.*

This is performed but by few perſons; ſome great undertakers ſupplying the whole conſumption.

The beſt alembic for this purpoſe, is that deſcribed p. 41. The pot may be made as large as the founders can conveniently caſt it, and conſequently very capacious; and a mode-

rate worm will be found ſufficient for the condenſation.

Tar has been ſubſtituted, in the place of turpentine, for the obtaining this ſpirit; which is the ſame in both; and, in this caſe, the colophony, or caput mortuum, left after the diſtillation of the ſpirit, will be pitch inſtead of reſin: but, to keep this pitch in a vendible ſtate, it is proper not to rob it of too much of the ſpirit, which would render it of too dry and brittle a nature, for moſt purpoſes. This ſubſtitution of tar, for turpentine, may be authorized in a medicinal view; as the ſpirit obtained from each is in all reſpects the ſame.

### *Rectified ſpirit of wine and alcohol.*

Take any quantity of French brandy, and diſtill off one half with a very gentle heat: this rectified ſpirit being digeſted for two days, with one fourth of its quantity of ſalt of tartar dried and powdered, and diſtilled with a very gentle heat, becomes alcohol.

### *Note.*

It is immaterial from what kind of cruder ſpirit the rectified ſpirit is made, provided there be no foul empyreumatic ſcent in it. The much higher price of French brandy than malt ſpirits, renders the latter preferable, on which

which account, the college of London have given no proceſs, but leave this preparation to the diſtillers, who can manage it with leſs expence than thoſe, who have occaſion to rectify ſmall quantities only. But for the ſake of ſuch as may not have an opportunity of procuring highly rectified ſpirits, or alcohol, on account of their diſtance from theſe large works, or who may want alcohol ſtronger than it is prepared there, I ſhall obſerve, that the digeſtion of the ſpirit and ſalt of tartar, as ordered in the above proceſs, is wholly unneceſſary, and the quantity of the ſalt far too large: and follow, therefore, a much better method.

*More expedite method of preparing highly rectified ſpirit of alcohol.*

Take malt ſpirit, rectified by one diſtillation, any quantity: add to it pearl aſhes, heated red hot, and powdered groſly, with the greateſt diſpatch, to prevent their cooling, in the proportion of one ounce of the ſalt to a pound of the ſpirit; ſhake the veſſel for ſome time, and after it has ſtood half an hour, or longer, repeat the ſhaking again for ſeveral times: the ſalt will then be diſſolved; and, having attracted the water, will occaſion its ſeparation from the ſpirit, which

will riſe above it; and muſt be parted from it by decantation. To the ſpirit thus ſeparated, then add, to every pound, one ounce of the ſalt, heated and powdered as before; and proceed again in the ſame manner as at firſt. After this ſecond decantation of the ſpirit from the ſalt, diſtill it in a retort, with a very large receiver, in the moſt gentle part of the ſand-bath.

If the ſpirit be not required very ſtrong, the addition of the ſecond quantity of the pearl aſhes may be ſpared; and where it is wanted exceedingly ſtrong, a third may be employed.

*Note.*

The ſeparation of the phlegm from the ſpirit, being made by the fixt alkaline ſalt, before the diſtillation, that operation is only required, in order to free the ſpirit from a very ſmall quantity of it, which may remain diſſolved in the unſeparated phlegm of the ſpirit: but, as the preſence of the ſalt does not in the leaſt deprave the ſpirit for any medicinal purpoſes, the trouble of the diſtillation may be ſpared; and the alcohol applied in this ſtate to all ſuch uſes. But, with reſpect to ſome other uſes, in which it is employed in ſome trades and manufactures, particularly

particularly in the making laquers and varniſhes, the diſtillation is indiſpenſibly neceſſary; as the alkaline quality of the ſalt would change the colour of the gum uſed in compoſitions of that kind; and other inconveniences might ariſe from the preſence even of the ſmalleſt quantity of the ſalt.

Boerhaave invented and recommended a ſpecies of alembic for this purpoſe, in which, means of a very tall head, of a conical form, he pretended the ſpirit might be freed, more efficaciouſly, from the phlegm, in one rectification, than by ſeveral, in the other kinds of alembic employed for this end: becauſe, as he ſuppoſed, the vapour of the phlegm and ſpirit aſcending up this tall head, would come in contact with the ſides of it, which being heated by them beyond the degree that ſpirit of wine can endure, without riſing in vapour, and yet under that which is ſufficient to raiſe water, the ſpirit would, therefore, be continued in the ſtate of vapour, and paſs into the pipe which is deſigned to carry it from the head to the refrigeratory; and the water be condenſed in the head itſelf; and run back into the body of the alembic. But though this appears very ſpecious in theory, it is of little avail in practice; for one point of heat alone being requiſite in the head to effect this properly, it is impracticable to maintain it; and if there be leſs, the fumes of the ſpirit will not be raiſed to the top of the head, ſo as to paſs into the pipe; or if more, the water will paſs

with it; as always happens ſhortly after the proper degree of heat be obtained.

### *Ethereal ſpirit.*

Take, of ſpirit of wine, four pints, of oil of vitriol one pound: mix, and diſtill them according to the directions below given for the ſpiritus vitrioli dulcis. Take the ſpirit which comes over; and add, to it, of oil of tartar per deliquium, or of the ſaturate ſolution of any fixt alkaline ſalt, four ounces, and mix them well together; and a ſubſtance, of the appearance of oil, will then riſe on the ſurface of the fluid; which muſt be taken off as quickly as poſſible; for it will exhale almoſt inſtantly, if it be expoſed to the air: add then further quantities of the ſolution of the fixt alkaline ſalt, one ounce at each time, and take off all the, oil that ſhall appear at each addition. It muſt be kept in phials, with glaſs ſtoppers, extremely well fitted to them; or it will eſcape by its extremely great volatility.

### *Note.*

This is the ethereal ſpirit, which Frobenius, a German chemiſt, firſt introduced the knowledge

ledge of here. It was then accounted only a curiosity; but since, it has a place given to it as a medicine, in the last edition of the dispensatory of the Edinburg-college.

### *Flowers of Benjamin.*

Put powdered Benjamin into an earthen pot, placed in sand: with a gentle heat, the flowers will rise; and may be caught in a taper cone, fitted to the pot.

The Benjamin may be, otherwise, put into a retort; and the flowers will rise, and be collected in the neck.

If the flowers be tinged with yellow, they are to be mixed with tobacco-pipe-clay, and resublimed.

### *Note.*

The college of London have given, in this process, an intimation of the method of subliming the flowers of Benjamin, by means of a paper cone; which is far preferable to the use of a retort, or to any other method practised: but the directions are so general and indistinct, that most, who have tried to avail themselves of them, and have not been otherwise apprized of the proper method, have greatly miscarried in their attempts; I will, therefore, subjoin some more particular directions, for the management of this process with the paper cone.

The pot is beſt made of the ſtone ware, ſuch as is manufactured at Vauxhall; and it ſhould taper in ſuch manner, at the top, that the paper cone may exactly fit it.

The paper ſhould be that called bloom, or blotting paper; the more ſpungy, in its texture, the better: the cone ſhould be formed of two ſheets laid together, and ſo adapted to the pot, as to come, only about two inches over the ſides of it, when put on. By having the cone of paper thus double, the oil will be the more abſorbed, and the flowers by that means freed from it.

It is beſt not to put the pot, which contains the Benjamin, immediately into the ſand-pot; but into another earthen pot, large enough to contain it with ſand round it; which larger earthen pot, being put into the ſand-pot, may be ſunk, or raiſed higher, at pleaſure: by which means, the heat of the pot, containing the Benjamin, may be varied in a very quick manner; and more eaſily adjuſted to the occaſion, than if it were placed in the ſand-pot. The heat muſt be very gently raiſed; and continued at that degree, which will raiſe the flowers in the ſloweſt manner; and it may be known by the warmth of the upper part of the cone, if it be ſufficient to that effect.

If the paper of the cone ſeem greatly foul with the oil, it ſhould be taken off, and a new one ſupplied.

By theſe means, with a very little experience, as to that nicety in the degree, which admits of

of no deſcription, the greateſt part of the flowers, in any quantity of Benjamin, may be obtained white, without any ſecond ſublimation.

*Purification, or refinement, of camphor.*

Take, any quantity of crude camphor, and put it into the glaſſes deſcribed as proper for this uſe p. 30: place the glaſſes upon the ſand, in the pots made as directed p. 25, for the ſublimation of calomel; and give the furnace a gentle degree of heat: the camphor will be raiſed in fumes; which will coaleſce, and form a cake on the upper part of the glaſs; and the operation muſt be continued, till the whole be ſublimed from the lower part of the glaſs; which may be known by the abatement of the heat in the upper: the glaſs muſt be broken, when cool; and if there be any foul part, in the cake of camphor, it muſt be ſeparated, in order to be reſublimed with any freſh quantity: the other part will be then proper for uſe.

*Note.*

As the camphor muſt be purchaſed of the Eaſt-India company, in conſiderable quantities,

to make the being concerned in the refinement of it profitable, there are very few who undertake to meddle with it: but it is an article very well worth the notice of those, who have the knowledge, and opportunity, of managing it rightly.

The greateſt nicety is in properly adjuſting the heat; which, if too great, endangers the burſting out of the fumes, as they are very elaſtic from the great volatility of the camphor; and making thence an intolerable waſte: or, otherwiſe, if the fire be too low, the fumes will ſettle on the ſides of the glaſſes, in the form of flowers, without attaining the chryſtalline texture; and, when theſe flowers are increaſed to a certain quantity, will fall down again into the bottom of the glaſs, and occaſion a tedious, and almoſt perpetual circulation. The method, however, to judge of the right heat, is to learn to diſtinguiſh it by feeling the glaſſes; and it is beſt to keep it up, at the higheſt point, which can be maintained, without forcing the vapour out through the neck of the glaſs: and in order to effect this more eaſily, it is proper to heat the furnace to the due degree, and continue it ſo for ſome time, before the camphor be placed upon the ſand.

There is another manner, in which camphor may be refined, with very little trouble, by thoſe who have occaſion to rectify ſpirit of wine from proof ſpirit: it is as follows.

*Purification,*

*Purification, or refinement, of camphor, by ſolution in ſpirit of wine.*

Take, any quantity of crude camphor; and diſſolve it in ſpirit of wine; making the ſolution as ſtrong as poſſible: let it ſtand at reſt, till all the feculencies be ſubſided; and then pour off the clear ſolution from the ſediment: filtering the remaining foul part through paper: add very clean water, then, to the ſolution, by very ſmall quantities, as long as any white turbidneſs appears to be produced on its further admixture: the camphor will then be precipitated to the bottom of the veſſel; but will be found to be in form of a powder; to reduce which into a chryſtalline cake, proper for ſale, the ſpirit of wine being decanted off from it, and ſome clean water added, put it into a Florence wine flaſk, and place it in a gentle ſand heat, till the camphor be melted; when the flaſk being taken off immediately, and broken when cold; the camphor will be found to be formed

formed into a tranſparent cake, ſuch as is commonly ſold.

*N. B.* The ſpirit of wine, being rectified, will ſerve again for the ſame purpoſe.

*Note.*

This is a very eaſy and profitable method to thoſe, who have opportunities of rectifying the ſpirit of wine, thus lowered by the addition of the water, along with other quantities; as giving, in that caſe, no additional trouble: and even, where the ſpirit of wine is purpoſely to be rectified, this is, perhaps, the eaſieſt way, if the quantity of camphor to be refined be conſiderable: though the firſt proceſs alone is at preſent practiſed.

## SECTION III.

### *Of the preparation of medicines, where foſſile ſubſtances, not metalline, make the whole, or principal part of the ſubject.*

*Calcined vitriol.*

LET green vitriol be put into one of thoſe earthen veſſels, called pipkins, which muſt be only three parts filled with it;

it; place the pipkin over a common fire, in a heat juſt ſufficient to make it boil: when the ebullition is almoſt over, the ſpace the vitriol at firſt took up in the veſſel will be greatly contracted; which muſt be again filled up with a freſh ſupply of vitriol; and the boiling continued till this, alſo, become quiet; and the veſſel muſt be thus recruited, till it become full of vitriol, after all ebullition ceaſe: the vitriol will be now a hard white maſs; and muſt be freed from the veſſel by breaking it.

If vitriol, calcined to redneſs, or as it is called, colcothar, be wanted, the veſſel ſhould not be broken, but put, with the vitriol in it, either into the body of the ſame fire, where it was calcined to whiteneſs, or into a wind furnace; and there continued till the vitriol appear red. After which it ſhould be ſeparated from the veſſel which will adhere to it; and, as ſoon as poſſible, put into a bottle, with a glaſs ſtopper, to prevent its deliquating in the air; to which it is in this ſtate extremely diſpoſed.

*Note.*

*Note.*

It has been uſual, in the proceſſes given for this preparation, to neglect any directions with reſpect to the filling the veſſel too full at firſt, by which means, the loſs of great part of it has generally happened; and the omitting, alſo, to refill the veſſel as the ſpace of the firſt quantity contracts, occaſions a loſs in the number of veſſels uſed to calcine any quantity; as they muſt always be broken: which, if this method be not practiſed, will be, as three to one, more than is neceſſary. It is uſual to ſubſtitute the caput mortuum, after the diſtillation of oil of vitriol, in long necks; as, alſo, that left after the diſtillation of aqua fortis, where vitriol is uſed, inſtead of the vitriol calcined to redneſs; but where the calcined vitriol is wanted to be applied as a ſtyptic to ſtop bleedings at the noſe, or elſewhere, this ſubſtitution is improper; as the too great calcination of the vitriol, in the diſtillation in long-necks deſtroys the ſtyptic quality; and in the caput mortuum of the aqua fortis, but a part of it is calcined vitriol; and the other part a ſubſtance, not correſpondent in the leaſt to the intention, and which, therefore, depraves the calcined vitriol.

*Oil of vitriol.*

Take any quantity of vitriol calcined to whiteneſs: powder, and put it into the earthen

earthen pots made for this purpoſe (called long-necks): let them be placed in their proper furnace, with a receiver luted to each; and raiſe the fire gradually to the higheſt degree, in which it muſt be continued, ſo long as any white fumes appear to come into the receiver: the fluid obtained in the receiver muſt be afterwards put into a retort; and placed in a ſand-furnace: the ſpirit, which firſt ariſes, muſt be taken out of the receiver as ſoon as the drops, which fall from the retort, appear extremely acid: the remaining part muſt be brought over, by means of a ſtrong fire; and the two kinds kept ſeparate for uſe; the one being called ſpirit, and the other oil of vitriol.

*Note.*

This is the authorized proceſs; but the preparation of oil of vitriol being ſeldom made, except by thoſe, who carry on very large concerns, and have no particular view to medicine, the preſerving two diſtinct kinds is ſeldom regarded: and, where ſpirit of vitriol is demanded, the oil lowered by an equivalent of water, is ſubſtituted for it: and is, in fact, the ſame thing; the acid, which riſes firſt, and

and that which comes afterwards, differing in nothing, but the being accompanied with a greater or leſs quantity of phlegm, impregnated with the ſulphureous gas produced in the burning.

This method, of producing the oil of vitriol, has been greatly excluded from uſe, by the improvement made lately in the art of obtaining this ſubſtance from ſulphur: by which means, the price has been reduced, in the wholeſale dealings, from ten pence, or one ſhilling per pound, to four pence. The proceſs was kept ſecret for ſome time; and is as yet in few hands: but, for the benefit of thoſe, who may either chuſe to enter into ſuch a work, in order to ſupply the market, or who may have occaſion for a conſiderable quantity for their own uſe, in any manufacture or buſineſs, I ſhall give here the moſt expedite manner hitherto invented of performing this proceſs.

*Manner of extracting the oil of vitriol from ſulphur, by means of the apparatus deſcribed p.* 44.

Take, of crude ſulphur or brimſtone, five parts, of crude nitre (or as it is called rough nitre), one part, powder and mix them well together: put this mixture, into the ſpoon-ſtoppers, in three layers; ſeparating each layer

layer by a thin wad of tow: ſet fire, then, to the ſulphur and nitre, with which the ſtoppers are thus charged, and put them into the necks of the globes; which, having firſt a gallon of water poured into them, muſt be placed in their proper frames, on the ſand-bath; but muſt not be ſuffered to go deeper into the ſand, than the height of the water: it muſt be alſo underſtood, that the ſand ſhould be previouſly ſo heated, as to raiſe a copious ſteam in the globe; but not greater than can be condenſed, without heating the ſides conſiderably. The ſtoppers being thus put into the globes, the materials contained in them will continue to burn; and will fill them with white fumes; which, meeting with the ſteam of the water, they will mix and be condenſed together on the ſurface of the glaſs: as ſoon as the materials ceaſe to burn, which may be known by the ceſſation of the white fumes, let the ſtopper be taken out; and another charged, in the ſame manner with the materials, put in its ſtead: and let this be repeated, till each of the

globes contains three or four gallons of fluid: then let them cool; and, when cold, take out the fluid by declining the neck by means of the frame.

Let the weak oil, thus obtained, be then put into retorts, and dephlegmated, by drawing off the aqueous fluid, till the remaining part be of due ſtrength; the degree of which may be regulated by the proportion that the water, put into the globes, bears to the quantity of the weak oil when taken out; by obſerving which, and fixing on a proper ſtandard for the ſtrength, it may be known when the oil is dephlegmated to the due degree, by the quantity of water brought over into the receiver, which ſhould be meaſured, when it is imagined that near the proper proportion is drawn off: but, as this cannot be performed, with reſpect to the contents of one retort, without the repeated trouble of taking off the receiver, it is proper to dephlegmate the contents of ſome particular retorts higher, and by mixing the ſeveral quantities dephlegmated in a number together, and meaſuring the reſpective

ſpective quantities of phlegm in the receivers, alſo, the whole may be eaſily brought to the ſtandard required, by means of the produce of thoſe retorts, which have been higher dephlegmated; in order to ſupply the deficience of ſuch as may be too low.

*Note.*

This is a method, by which oil of vitriol may be obtained at a very low expence: eſpecially, if the quantity manufactured together be very conſiderable: and other preparations, ſuch as aqua fortis, ſal mirabile, ſublimate, &c. in which the undephlegmated ſpirit may be uſed, are likewiſe carried on, together with this.

The principle, on which the improvement in this method depends, is, the burning the ſulphur with nitre, inſtead of being obliged to ſuffer an acceſs of air: the draught of which, of courſe, carries off with it, the fumes of the ſulphur; as was always found in the ſeveral manners of the proceſs, for diſtilling this ſubſtance by means of glaſs bells, or other ſuch veſſels; by the beſt contrived of which, but a ſmall quantity of the acid ſpirit could ever be collected. Whereas, by the uſe of nitre, the ſulphur being burnt in a cloſe veſſel, without any ſteam of air to carry off the acid vapour; which, on the contrary, in this method, meets

continually with the ſteam of water, that greatly aſſiſts its condenſation, almoſt the whole quantity of this ſubſtance, contained in the ſulphur, is obtained: and by ſuch expedite means, as renders the expence ſmall, where a large work is carried on.

The invention of this method is generally given to the perſons, who a few years ago took out a patent for it: but it is very well known, that Cornelius Drebbel, a Hollander, amongſt other improvements of arts, found out a method of obtaining five ounces of the acid ſpirit, from eight ounces of ſulphur: and though the practice of this art was, on his death, diſcontinued, yet I can produce the model of an apparatus, for extracting the acid ſpirit from ſulphur by means of nitre, which was made a conſiderable time before that patent was applied for.

Though I call this oil of vitriol, as almoſt the whole now ſold, under that name, is the ſpirit of ſulphur thus prepared; and the acid of vitriol does not differ from it, when both are pure, as was before ſhewn p. 80: yet this is not, in reality, the pure vitriolic acid; for, by this uſe of nitre, in its preparation, it contains an eight or ninth part of ſpirit of nitre; which is ſet looſe from the nitre, in the deflagration. But though this may poſſibly deprave it, with reſpect to ſome nice experiments, and extraordinary purpoſes; yet it very well anſwers the purpoſe of pure oil of vitriol, with reſpect to its uſe in the arts and manufactures, in which it is employed; and may be, likewiſe, allowed as

a ſubſtitute, either for the oil of vitriol, or ſpirit of ſulphur by the bill, for all medicinal purpoſes. And this may, therefore, be looked upon, as one of the moſt important inventions, that have been of late made public.

### *Spiritus vitrioli dulcis, or dulcified ſpirit of vitriol.*

Take, of oil of vitriol, one pound, rectified ſpirit of wine, one pint: mix them, gradually, with the utmoſt care: and diſtill them, with a very ſlow fire, till a black froth begins to riſe: then, immediately, let the receiver be taken away, leſt the froth riſe into the neck of the retort, and flow into it.

*Note.*

This is the proceſs of the London college; in which, the proportion of oil of vitriol is much greater than has been generally uſed: and indeed than is neceſſary, as the far greateſt part of it will be left behind in the retort. The college of Edinburg have ordered only ſix ounces of the oil of vitriol to four pounds of the ſpirit of wine: but as the oil of vitriol is a very cheap ingredient, one pound to four may be uſed; which, if ſomething more than ſufficient, cannot, therefore, occaſion any material loſs.

The intention of ſo large a quantity of oil of vitriol, was, to render this a previous preparation for the elixir vitrioli dulcis: but, as there can be only a certain proportion of the acid raiſed, by the ſpirit of wine, the adding more, in the undiſtilled mixture, cannot produce a greater proportion in the diſtilled ſpirit; unleſs a much ſtronger heat than that of the ſand-baths, in which this medicine is, (and ought to be,) prepared, were to be uſed.

In this proceſs, the greateſt care ſhould be taken, in mixing the two ingredients: for which, the ſafeſt method is, to add the oil of vitriol to the ſpirit of wine, by ſmall quantities; and to let the mixture ſtand each time, without further addition, till it can be ſhaken without producing any ſenſible heat. When the whole is commixt, it ſhould, likewiſe, be ſuffered to ſtand, ſome time, before it be diſtilled: but there is no occaſion for digeſting it ſeveral days; as is directed by the Edinburg college.

The uſual adulteration of this medicine, is, by lowering it with water; which may be perceived by its loſing the volatile pungency, and ſuffocating ſcent, that it gives to the air around it, when any veſſel containing it is opened.

## *Spirit of nitre.*

Take, of ſalt petre, and oil of vitriol, equal quantities, of water, the proportion of

of one fourth or fifth to the other ingredients: mix the oil of vitriol, and water, by adding the former to the latter in ſmall quantities; giving time for the mixture to cool betwixt each addition; to avoid the heat, which will be otherwiſe excited, to ſuch a degree, as may break the veſſel that contains the mixture, and produce other inconveniences. Put the ſalt petre into a retort, and afterwards the oil of vitriol and water: when the whole is mixt together, let them ſtand ſome hours, the mouth of the retort being ſtopt with paper; and then lute on a receiver, and diſtill them, with a heat gradually raiſed to the greateſt degree, while any red fumes appear to riſe.

*Note.*

This is the regular and common proceſs for ſpirit of nitre; but it is faulty in ſeveral reſpects.

The quantity of oil of vitriol is far too great, for that of the ſalt petre: half the weight of oil of vitriol being ſufficient, to diſcharge its proper ſpirit from the nitre, as appears, as well from clear reaſons drawn from the nature of the two bodies, as from experience: and, when this redundant quantity of the oil of vitriol is uſed, either near one half will be left behind in

the retort, if the fire be not very powerful, or the ſpirit, which comes over, will not be ſpirit of nitre; but a compound of almoſt equal parts of the ſpirits of nitre and vitriol. It is impracticable, indeed, to obtain a pure ſpirit of nitre, if this proportion be adhered to, which, tho' not very important with regard to all medicinal purpoſes, is yet ſo for ſome; as particularly in the ſolution of mercury, for the preparation of red precipitate; and, in the greateſt degree, with reſpect to the arts of gilding, and others, where ſpirit of nitre is wanted. On the contrary, the proportion of the oil of vitriol to the nitre, in the diſpenſatory of the college of London, is much too little: being but as one to three; which is not ſufficient to diſcharge the acid from the whole quantitity of nitre; and, therefore, not only waſtes ſo much of the nitre, as a half exceeds a third, but, alſo, diminiſhes the produce of the operation, in the ſame proportion, by filling the retort in part, with fruitleſs ingredients.

The putting the water, with the oil of vitriol, into the retort, is likewiſe an error, as it protracts the operation; and is of no uſe with relation to the diſſolving the ſalt-petre, as is intimated in ſome proceſſes given for this preparation; but only in rendering the fumes more condenſible; which end, it full as well anſwers, when put into the receiver before it be joined to the retort.

The uſe of purified nitre, or ſalt-petre, is, alſo, an unneceſſary expence: for the crude nitre

nitre (or rough petre, as it is called) will equally well anſwer the end: and is to be procured at a conſiderable leſs price. But there being two kinds of this brought from the Eaſt-Indies, the one a purer kind, called the white petre; and the other a fouler, called the brown, it is proper to take care, that the firſt of theſe kinds be employed; eſpecially, if the ſpirit of nitre be uſed for any ſuch medicinal, or other purpoſes, as require it to be pure: for the brown nitre being ſeldom free from a conſiderable proportion of ſea ſalt, the acid ſpirit, produced from it, muſt be neceſſarily an imperfect aqua regia; and, therefore, not ſo fit for gilding, and many other uſes.

I ſhall, therefore, after treating of thoſe proceſſes for the ſpirit of nitre, which are given under the name of preparations of aqua fortis, endeavour to ſhew the moſt expedient and profitable method of obtaining pure ſpirit of nitre, proper either for thoſe purpoſes, where it is required to be pure; or where the commixture of oil of vitriol with it is neceſſary.

### *Single aqua fortis.*

Take, of crude vitriol, three pounds, of nitre, two pounds: grind, and mix them well together: put the mixture into earthen veſſels, called long-necks, which muſt be filled about two thirds; and place them in

a reverberatory furnace, made for this purpose: lute on receivers fitted to their necks; after which diſtill, with a fire gradually raiſed to the higheſt degree.

*Note.*

By the words, aqua fortis, as diſtinct from ſpirit of nitre, is to be underſtood a compound of ſpirit of nitre, and oil of vitriol: for, from the proportion of the vitriol uſed, as well in this, as all the other proceſſes given for acid ſpirits, under the name of aqua fortis, it will be evident, on examination, that a quantity of oil of vitriol muſt riſe along with the ſpirit of nitre; if the fire be of due ſtrength: as the quantity of vitriol uſed, contains much more acid, than can be fixed by the alkaline part of the nitre.

This is the proceſs formerly uſed, for diſtilling what is improperly called the ſingle aqua fortis; but ought rather to be called the weak: as differing in nothing from that called the double; but in containing more water, on account of the vitriols being uſed without any previous calcination. This, therefore, renders ſuch a proceſs, in its nature, abſurd; as being unprofitable and needleſs: for, beſide the inconvenience, which is liable to happen, from the ebullition of the vitriol, that occaſions half the contents to overflow, if the fire be not conducted with a caution more than is practicable, till the water, which aſſiſts in forming the chryſtals of the vitriol, be come over, the long-

necks

necks are prevented, from holding the quantity they would otherwiſe contain, by the greater bulk, which the vitriol has in this ſtate, than when calcined. The nitre is likewiſe ſubject to ſink to the bottom, when the vitriol is melted into a fluid ſtate; as happens always, in this caſe, from the water it contains; and this prevents ſuch a due commixture, as is neceſſary; in order that the acid of the vitriol may act on the nitre, to ſeparate the ſpirit from it: and, for theſe ſeveral reaſons, this proceſs has been greatly diſuſed of late.

But the college of London do not ſeem to have greatly reformed theſe errors, of the old proceſs for the ſingle aqua fortis, in the proceſs given laſt by them for the double; which, according to the old manner of preparing it, was made by means of vitriol calcined to redneſs. For, tho' they have ordered part of the vitriol to be uſed uncalcined, and part of it calcined to redneſs, as it were by mixing the two extremes to find a remedy in each for the other; yet as we ſhall ſee, on our remarks on this proceſs, inſtead of removing theſe inconveniencs, they have only added others.

*Preparation of aqua fortis, according to the diſpenſatory of the college of London.*

Take, of nitre and green vitriol uncalcined, each three pounds; of the ſame vitriol

triol calcined to redneſs, one pound and a half: mix them thoroughly; and diſtill with a ſtrong fire, as long as any red fumes ariſe.

*Note.*

The principle, on which this alteration, or rather combination, of the two proceſſes, for the ſingle and double aqua fortis, is grounded, is too myſterious to be underſtood; for, though the proportion of phlegm, betwixt this mixture of vitriol wholly uncalcined, and calcined to redneſs, may not differ greatly from that of vitriol calcined to whiteneſs: yet, as in the calcination to redneſs, a conſiderable part of the acid (as is obſerved above,) being driven off, to allow for which, the whole quantity of vitriol is here augmented, (the acid of the vitriol being the medium, by which the ſeparation, is made of the ſpirit from the nitre), this occaſions a greater conſumption of the vitriol, and a needleſs filling of the veſſel in which they are diſtilled; beſides the inconveniences liable to happen, from the boiling over of the uncalcined vitriol, and the ſeparation of the nitre from it while melted, without the leaſt convenience or ſaving to counterballance theſe diſadvantages.

It is, therefore, much better, when the method of making aqua fortis, by means of crude vitriol, is followed (which, as I ſhall ſhew below, may be much better changed for another,) to

to uſe the due proportion of vitriol calcined to whiteneſs, as is directed by the college of Edinburg; and practiſed by thoſe, who beſt underſtand this art: by which not only the ebullition in the uncalcined vitriol, and tediouſneſs of keeping back the fire with great care till all the phlegm be come over, are avoided; but the due commixture of the ingredients is preſerved, during the whole operation; and the quantity capable of being diſtilled in the ſame veſſel, conſiderably augmented; which, in this caſe, enhances the profit in a very material degree. But as the proportion of nitre is much too great in the Edinburg proceſs, the following one, in which all theſe ſeveral errors are reformed, and which is more conformable to the preſent practice of thoſe, who carry on this art as a manufacture, may be allowed to be the beſt hitherto given.

*Improved proceſs for the preparation of aqua fortis, from nitre and crude vitriol.*

Take, of vitriol calcined to whiteneſs, and of crude nitre, each equal parts; pound, and mix them well together: put them into the iron pot, deſcribed as part of the apparatus for this purpoſe, p. 47; and fit on the head; making good the joint with fire lute; the receiver being alſo luted

to

to the arms: diſtill with a fire increaſed, gradually, to the greateſt degree; and continued as long as any red fumes appear.

*Note.*

It will be proper here, and in all the diſtillations of ſpirit of nitre, to leave a ſmall hole, made with a wire or pin, in the lute of the necks of the receivers; in order to give a vent for the air, generated by the action of the oil of vitriol on the nitre; and which, otherwiſe, will ſtrain, and open, the lute, to the annoyance of the operator, and loſs of part of the ſpirit.

Since the improvement, in the method of obtaining it from ſulphur, has ſo greatly diminiſhed the price of oil of vitriol, this method of uſing crude vitriol, for the making of ſpirit of nitre, is rendered much leſs profitable, than the obtaining it by means of the oil of vitriol. And the making aqua fortis, by any method, diſtinct from that uſed for ſpirit of nitre, is alſo needleſsly troubleſome: for, as the difference of them wholly conſiſts, in the addition of oil of vitriol to the other; when the ſpirit of nitre is obtained, the oil of vitriol may be added to it, in any proportion found neceſſary; and it may be then extemporaneouſly changed into any kind of aqua fortis; and the ſame end conſequently anſwered with greatly leſs trouble and expence.

I ſhall, therefore, ſubjoin the beſt method of procuring pure ſpirit of nitre, by means of oil of vitriol: which may be uſed, in that ſtate, by the refiners, gilders, &c. to whom the purity is of the higheſt conſequence; and commixt with a due proportion of oil of vitriol, for the uſe of the braſs founders, dyers, &c. to whom this compound, or the aqua fortis, as it is called, is neceſſary.

*Beſt method of procuring pure ſpirit of nitre, for the purpoſes of gilding, refining, &c. and which may be, likewiſe, on all occaſions, converted into any kind of aqua fortis.*

Take, of crude nitre, (called rough petre), the white kind, twenty four pounds: put it into a retort of a proper ſize; and add to it of oil of vitriol, twelve pounds: fit on a very large receiver, firſt pouring into it ſix pints of water: diſtill them with a fire gradually increaſed to the higheſt degree.

If the ſpirit be required to be exceeding ſtrong, a pint or two of the water, directed to be put into the receiver, may be left out.

*Note.*

This is the proper proportion of the oil of vitriol to the nitre, for obtaining the ſpirit of nitre, in

in the greateſt degree of purify, in which it is commonly had; and which, in this ſtate, is fit for the uſes of the gilders and refiners: but as it is very neceſſary, for the ſolution of ſilver to make the lunar cauſtic, and for many other purpoſes, in arts and manufacturers, to have it perfectly pure, I will here give the method, uſed by the refiners, for that purpoſe; which at the ſame time ſupplies the means of diſcovering, and remedying, the impurity of it in the moſt accurate degree.

*Method of proving, and purifying, the ſpirit of nitre.*

Take a ſmall quantity of ſpirit of nitre: diſſolve in it as much ſilver, as it will take: put a few drops of this into ſome of the ſpirit of nitre, that is to be proved; and, if the ſpirit remain tranſparent, it may be concluded to be pure; but, if a white cloudineſs be perceived, which will afterwards form a ſediment, it may be, with certainty, inferred, that there is ſome commixture of oil of vitriol, or ſpirit of ſalt, with it.

In order, therefore, to render the ſpirit of nitre abſolutely pure, drop the ſolution of ſilver gradually into it, ſo long as it ſhall produce

produce the leaſt turbidneſs; time being given for the ſpirit to become clear betwixt each addition: the ſpirit of nitre, being then poured off from the ſediment, will be perfectly pure: and if this ſediment, which is the ſilver precipitated, be evaporated to dryneſs, and then fuſed in a crucible, with a ſmall quantity of fixt alkaline ſalt of any kind, it will be reduced to its proper metalline ſtate.

*Note.*

By this method, ſpirit of nitre may be rendered, with very little trouble, or expence, of an abſolute purity; and fit either for the ſolution of ſilver, or any other experimental, or uſeful purpoſe, where ſuch purity is neceſſary: but, as the commixture of a certain proportion of oil of vitriol with it, is equally requiſite for ſome purpoſes, as its being intirely free from that acid is for others, I will ſubjoin a ſimple method, of changing it into double or ſingle aqua fortis; which, as we obſerved before, are only compoſitions from theſe two acids.

*Method*

*Method of converting pure ſpirit of nitre into double or ſtrong aqua fortis, proper for the uſe of founders, &c. in cleanſing braſs work after it is caſt; as alſo for engravers and etchers of copper plates.*

Take, of the pure ſpirit of nitre, nine pounds, of oil of vitriol, one pound: mix them together.

*Note.*

The ſpirit of nitre, if made expreſsly for this purpoſe, may be prepared, with fourteen pounds of oil of vitriol, inſtead of twelve to twenty four of the crude nitre: and, in this caſe, only half a pound of the oil of vitriol muſt be added afterwards.

This is the only purpoſe where double aqua is neceſſary: but, as the ſingle is uſed on many different occaſions, and particularly by the dyers, in very great quantities, it is proper to ſhew, how it may be beſt made from the pure ſpirit of nitre.

*Method of converting the pure ſpirit of nitre into ſingle aqua fortis, for the uſe of dyers, &c.*

Take, of the pure ſpirit of nitre, twenty pounds, of oil of vitriol, ſeven pounds: mix

mix them well together; and add of water thirty pounds.

*Note.*

This mixture is particularly accommodated to the purpoſes of dyers: but, it will anſwer extremely well, alſo, to thoſe, who uſe ſingle aqua fortis, for mixing with water, in order to the cleaning copper, or braſs work: and will be found no way different from that diſtilled immediately from an equivalent proportion of nitre and vitriol. It is, if made in the above proportion, near the ſtandard of the beſt Dutch aqua fortis, uſually ſold to the dyers: but that may be eaſily regulated, if there be occaſion to make it correſpond with any fixt price, by the reducing it lower by the further addition of water: and it may be compared, accurately enough, with any other, by means of their ſpecific gravity; which may be found, by filling a ſmall glaſs globe, having a narrow neck, with each kind; and obſerving their agreement, or difference, on weighing them in a pair of ſmall ſcales.

By this treatment of the aqua fortis, it may be afforded, with conſiderable profit, at a much lower rate than it is ſupplied from Holland: eſpecially by thoſe, who manufacture the oil of vitriol themſelves, according to the new method: or it will very well anſwer for dyers, or others, who uſe great quantities to make what they uſe themſelves, (which, according

to the proceſs above given, may be managed in a very ſmall compaſs): particularly, while oil of vitriol ſhall continue at the low price of four pence per pound.

## *Spiritus nitri dulcis, or dulcified ſpirit of nitre.*

Take, of rectified ſpirit of wine, two pints, of Glauber's ſpirit of nitre, (that is to ſay, the kind made with oil of vitriol) half a pound: mix them, by pouring the ſpirit of nitre on the other; and diſtill the mixture, with a gentle heat, as long as what comes over will not raiſe any fermentation with alkaline ſalts.

### *Note.*

The proportion of half a pound of the ſpirit of nitre, to two pints of the ſpirit of wine, is much too great: for, as it is particularly intimated, by the caution, not to ſuffer the remaining ſpirit of nitre to riſe after the ſpirit of wine be come over, that redundant acid is injurious to the dulcified ſpirit, it is, conſequently, unneceſſary to uſe more than the quantity of ſpirit of wine can carry over with it; which will be leſs than half this proportion: and this diminution of the quantity will ſuffer the whole to be drawn over, without the trouble

trouble of watching the critical point; or making experiments with alkaline ſalt.

It is neceſſary to be extremely cautious, in making the dulcified ſpirit of nitre, as well that as of vitriol, in mixing the ingredients together: eſpecially, if the ſpirit be highly rectified: for an exploſion frequently happens; particularly, when near the whole quantity of ſpirit of nitre has been added to the other. It is beſt, therefore, to put in only very ſmall quantities at a time; and to let the mixture ſtand, after each addition of the ſpirit of nitre, till no heat appear to remain; or even to ariſe on ſhaking the veſſel.

The diſtillation of dulcified ſpirit of nitre is beſt performed in retorts, placed in the cooleſt part of the ſand-bath, with very large receivers fitted into them.

The dulcified ſpirit of nitre is very frequently adulterated with water, from which the unſophiſticated may be beſt diſtinguiſhed, by the ſtrength of that peculiar and grateful ſcent, this compoſition has, when duly prepared; and which is always proportionably abated by any addition of water; and almoſt wholly deſtroyed, when lowered beyond that degree of ſtrength, called proof, in the ſpirit of wine.

### *Sal prunellæ.*

Take any quantity of ſalt-petre: melt it in an earthen pot, or clean iron kettle:

when it is well melted, caſt a little of the flowers of ſulphur upon it; and, when that is burnt, put on more; and continue to do ſo, till the nitre flow as clear as rock water, without any ſcum: then, with a clean iron, or braſs ladle, take it out of the pot; and put it into a warm braſs pan or mold: when that is fixed, put it by; and, with the ladle, take out more, till the melted ſalt be all caſt; which keep for uſe.

*Note.*

This is the old proceſs for ſal prunellæ. The Edinburg college have fixed the proportion of ſulphur to be one ounce to two pounds; which makes the medicine, then, a compound of two ſalts: for the greateſt part of the nitre will be left unchanged; and mixed only with ſo much of a new ſalt, as that proportion of ſulphur could act upon, and convert into one.

In the above proceſs, by melting, muſt be underſtood the fuſion of the nitre; as no fluid is to be added to it to diſſolve it: and, as this requires more than the firſt degree of red-hot heat, earthen pots will be ſcarcely found able to endure ſo ſtrong a fire, without cracking; and, as to the iron kettle, I do not ſee how that can be conveniently put into the fire: beſides, that

that the nitre, before the ſulphur be added to it, will calcine the iron, or any other metal, except gold or ſilver, by deflagrating with the ſulphur contained in it. It is, therefore, better, to perform this operation in a large crucible.

When ſal prunellæ is made with the proportion of ſulphur above directed, it is, as I have ſhewn before p. 82, exactly the ſame with the vitriolated tartar, ſal polychreſtum, and ſal enixum; that is to ſay, it is a neutral ſalt, formed from fixt alkaline ſalt, and the acid of vitriol. As theſe ſalts are, therefore, all the ſame, except, as to the different method of obtaining them, that, which can be cheapeſt procured, may be ſubſtituted for the other; and the caput mortuum, after the diſtillation of ſpirit of nitre, by means of oil of vitriol, may be formed into ſal prunellæ as well as tartar vitriolate, by a proper change of the method; which may be the following.

*Method of forming ſal prunellæ from the ſal enixum, or caput mortuum, after the diſtillation of ſpirit of nitre, made with oil of vitriol.*

Take any quantity of the ſal enixum, or caput mortuum left after the diſtillation of the ſpirit of nitre; and, if it be acid, add to it a ſmall quantity of fixt alkaline ſalt:

put it into a crucible; and give it a heat ſufficient to fuſe it, or make it run into a fluid ſtate: but if, on trying, in this ſtate, it yet appear acid, more of the fixt alkaline ſalt may be added, till no acidity remain. It muſt be then caſt into molds; or, what is more convenient, poured out, by ſmall ladlefulls, on a ſmooth copper, or iron plate; which will form it into thin cakes; ſuch as are uſually ſeen in the ſhops. If any brown colour appear in it, a little nitre may be added to it, while in this ſtate of fuſion; which will bring it to perfect whiteneſs.

*Note.*

If the ſal prunellæ be deſired, to be ſuch a compound of the two kinds of ſalts, as the proceſs of the Edinburg college ſeems to intimate to be proper, a proportion of nitre may be added at pleaſure to this ſalt, while in a ſtate of fuſion, which will effect the ſame, as if the ſal prunellæ were made from nitre and ſulphur, in an equivalent proportion.

*Sal polychreſt.*

Mix equal parts of ſulphur and nitre, in fine powder; and put them into a red-hot crucible,

crucible, by a ſpoonful at a time; obſerving, as ſoon as the exploſion cauſed by one ſpoonful be over, to put in another; and continuing to do ſo till all the mixture be uſed: put then a tile over the top of the crucible; and, covering the whole over with coals, keep the ſalt in fuſion four or five hours: then pour it into a warm copper veſſel; and, when cold, powder and diſſolve it in warm water: filter the ſolution; and evaporate till it be dry.

If this ſalt be not ſo white as deſired, put it again into a crucible; and ſet it in a ſtrong fire for three or four hours longer; continually ſtirring it till it be very white: then again diſſolve, filter, and evaporate to dryneſs.

*Note.*

This is the common proceſs for making this ſalt: but it is not a very good one. The keeping this ſalt in fuſion ſo long is wholly unneceſſary; for it is properly formed as ſoon as the exploſion ceaſes.

The forming this ſalt into chryſtals is wrongly omitted: for, if it be required only in a dry maſs, improper ſubſtitutions will be ſold in its place; againſt which, the particular appearance

of the chryſtals, when once known, is a ſecurity. But, as, probably, ſuch ſubſtitution will be the unprepared caput mortuum, after the diſtillation of ſpirit of nitre, it may be diſtinguiſhed by its acid taſte; which ſhould be wholly wanting in the ſal polychreſt.

As this, no ways, differs from the tartar vitriolate, it is unneceſſary to repeat here again, in what manner it may be moſt profitably and perfectly prepared; as, what is before ſaid on that article, may be conſulted with regard to this.

### *Sal mirabile, or Glauber's ſalt.*

Take, of clean ſea ſalt, fountain water, and oil of vitriol, each two pounds: mix the oil of vitriol, with the water, thus. Firſt put the water into an earthen veſſel; then put the oil of vitriol to it, by two or three ounces at a time; for, if more be put in together, it will endanger the breaking of the veſſel, by the violence of the heat that will be produced: put, then, the ſalt into a retort, ſet in a ſand-pot; and add the oil, and water, to it; fit on a receiver, and diſtill with a fire gradually increaſed to the greateſt degree. Take the ſalt left in the retort after the diſtillation; and diſſolve it

in

in water: filter, evaporate to the due point, and ſet the ſolution, to form chryſtals, in a cold place.

*Note.*

This is the old proceſs for Glauber's ſalt. The college of London have reduced the quantity of water to one half; which is very proper: becauſe the real uſe of it, being only to render the fumes of the ſpirit of ſalt more condenſible, a redundant quantity only protracts the operation, by making a longer diſtillation neceſſary.

The college of Edinburg have diminiſhed the quantity of oil of vitriol to one half; which is, certainly, a much better proportion than that of the college of London. With reſpect to the quality of the Glauber's ſalt produced, it is wholly indifferent what quantity of ſea ſalt is uſed; but, with reſpect to profit and expedience in the operation, it is far otherwiſe: for, if the quantity of oil of vitriol be greater, than is ſufficient to expel the acid of the ſalt, it will require a great degree and continuance of fire, to drive it over; and, when the ſalt is freed from it, as well as it can be, by the heat of a ſand furnace, it will render the ſolution ſo acid, that the chryſtals will take a very long time in drying; and be themſelves too acrid, from the acid which will remain with them, for the intention of the medicine. The beſt proportion, therefore, that can be ſettled, is, by

by adjuſting the quantities in ſuch manner, that there may be a ſmall quantity more of the oil of vitriol than can be fixed by the alkaline baſis of the ſea ſalt; which, according to the preſent ſtandard of oil of vitriol, is about nine ounces of the oil of vitriol to a pound of the ſea ſalt: and, if the Glauber's ſalt produced ſhould not ſhoot freely, as will ſometimes happen, if the ſolution be wholly void of acid, a little oil of vitriol may be added; which will certainly anſwer that purpoſe the ſame, as if it came out of the retort with the ſalt.

The uſe of an earthen veſſel, in the above proceſs, is wrong: for all earthen veſſels make a waſte of fluids put into them, if they be not glazed; and ſuch as are ſo, are liable to have the glazing immediately corroded and eaten off, when acid ſpirits of any kind are put into them.

This medicine, though of great importance in practice, was, for ſeveral years, almoſt excluded by the ſubſtitution of a counterfeit kind, made firſt at Limington, and afterwards elſewhere; of which, I ſhall ſpeak more particularly below: but the uſe of this counterfeit, being in its turn ſuperſeded greatly by the late improvements made in the preparation of the genuine kind, and the eaſy method of obtaining oil of vitriol from ſulphur, by which they have reduced the wholeſale price even to four pence per pound, I will ſhow the moſt expedite and cheap methods, by which, the true kind is, or may be made.

*Moſt profitable and eaſy method of preparing the true Glauber's ſalts, by means of the apparatus deſcribed p.* 33.

Take, of ſea ſalt, twenty four pounds; and put it into a retort of a proper ſize: add to it, of oil of vitriol, fourteen pounds, mixed, very gradually, in a glaſs receiver, with ten or twelve pints of water: ſet the retort in a ſand-pot; and let it ſtand there for ſome hours the mouth being ſtopped with paper: diſtill then, with a heat gradually raiſed to a pretty ſtrong degree, till no more fumes come into the receiver: after the furnace is properly cooled, take the cake of ſalts out of the retort; and diſſolve it, in boiling water, in caſe of very large quantities in the leaden boiler deſcribed p. 33, or, otherwiſe, in a large pipkin of ſtone ware: filter the ſolution through earthen cullenders; and put it either in the leaden veſſels, or large receivers, above deſcribed: and let it ſtand to ſhoot. After the chryſtallization is finiſhed, which muſt be concluded from the chryſtals

chryſtals not appearing to grow bigger, the mothers (or fluid remaining after the ſhooting of the ſalts) muſt be poured off from the ſalts in the receivers; and the ſalts ſet to drain in the earthen cullenders, or proper baſkets; or, if in the leaden ciſtern, they muſt be taken out into the baſkets, provided for this purpoſe; and, when drained there to a proper degree, laid on the frame of baſket work to dry.

*Note.*

By this method, if the oil of vitriol continues at the very low price, for which it is ſold at preſent, the true Glauber's ſalt may be made at ſo cheap a rate, that one may hope to ſee intirely rejected the counterfeit kind, known, among the dealers in medicine, by the name of the Lymington ſalts, and ſold in the ſhops under the name of Glauber's ſalt; of which name, the genuine kind was ſo much robbed, that it was diſtinguiſhed from this by the name of ſal mirabile: but, as there yet remains ſome demand for them, either amongſt thoſe, who are ignorant of the real difference betwixt them and the true kind, or who are induced, by ſome ſmall advantage in the price, to prefer them, I ſhall ſhow what they really are; and how converted into that form, which makes them paſs for the genuine kind.

*Method*

*Method of producing the Lymington, or counterfeit Glauber's ſalts, from the ſal catharticum amarum, or Epſom ſalt, as it is called in the ſhops.*

Take the Epſom ſalt, (which is the ſal catharticum amarum, ſhot into chryſtals from the bittern, or mothers of the ſea ſalt, when obtained from ſea water); and diſſolve it in boiling water: put it into proper veſſels; adding, to every gallon of the ſolution, an ounce or more of oil of vitriol: let the chryſtals form; and then take them out, and dry them. This may be done, alſo, with the bittern itſelf; and the counterfeit Glauber's ſalt produced, without any previous formation of them into the fictitious Epſom ſalt.

*Note.*

The ſal catharticum amarum, treated in this manner, reſembles greatly the appearance of the true Glauber's ſalt; and, as it is to be obtained, in very great quantities, from the mothers, (or fluid remaining after the chryſtallization of the ſea ſalt, when made from ſea water,) by this ſimple and cheap proceſs, it was ſold for

for ſo low a price, that the ignorant and greedy traders in medicine ſoon received it, after its firſt invention, in the place of the genuine ſal mirabile: the uſe of which, it almoſt excluded, till the later improvement reſtored it by reducing the price nearly to a level with this. As this counterfeit is, however, in no degree comparable to the true kind as a medicine, being nauſeous to the ſtomach, and apt to produce a violent ſickneſs and gripings, I will give an infallible method of diſtinguiſhing the one from the other: that they, who are deſirous, may not have this ſubſtitution impoſed upon them, through ignorance of the means of diſcovering when it is attempted.

*Method of diſtinguiſhing the Lymington, or counterfeit, Glauber's ſalt, from the true kind.*

Take, any quantity of the ſuſpected ſalt; and diſſolve it in clean water: and, when the ſolution is become clear, and limpid, add to it a ſmall quantity of the ſolution of ſalt of tartar, or any other fixt alkaline ſalt, made clear likewiſe: if no change happen on the commixture, but the mixt ſolutions continue to be as clear and tranſparent as when ſeparate, it may, with certainty, be concluded,

cluded, that the ſalt, thus examined, is the true Glauber's ſalt: but, if a milky turbidneſs appear, which will afterwards be ſucceeded by the precipitation of a powder, it may thence be known to be the Lymington counterfeit. On the want of fixt alkaline ſalt, to make this experiment, volatile ſalt may be uſed, in its place, with the ſame effect.

*Note.*

By this method, the true ſal mirabile may be always known from this counterfeit, by thoſe who are unaquainted with either kind: but thoſe, who are more converſant with matters of this nature, may eaſily diſtinguiſh them from each other, by a bitter ſtyptic taſte, which the Lymington ſalt has in a much greater degree than the other; and by the form of the chryſtals; which in the true Glauber's ſalt are longer, and more of the figure (as it were) of long ſquare needles.

## *Magneſia alba.*

Take, any quantity of the mothers, or fluid remaining, after the chryſtallization of the ſalt-petre, in the refinement of crude nitre: add to them, gradually, a ſolution of

of fixt alkaline ſalt, as long as any effervescence, or white turbidneſs, appear to be produced. By theſe means, a white powder will be precipitated: which, being ſeparated from the fluid, freed from the remaining ſalt by waſhing, and afterwards dryed, is the original magneſia alba.

*Note.*

This is the true and original proceſs, by which the magneſia alba of Hofman was made: but, as very little earth is to be obtained from nitre, other precipitations have been made from ſubſtances, which afford it copiouſly; and have been ſubſtituted in the place, and wholly excluded the uſe, of this. That, which has moſt commonly been practiſed, is as follows.

*Method of making the fictitious magneſia alba; which is the only kind uſed here.*

Take, of the ſal catharticum amarum, or Epſom ſalt, any quantity: diſſolve it in water: diſſolve, alſo, half the ſame weight of pearl aſhes; and filter the ſolution. Add the ſolution of pearl aſhes to that of the Epſom ſalt; at firſt in pretty large quantities,

ties, but afterwards more gradually, ſo long as any efferveſcence, or turbidneſs, appear to enſue the admixture. After the powder, which will be, by this means, precipitated, has wholly ſubſided to the bottom, and the fluid be become clear, decant off, all that can be ſeparated, from the powder; and put the remainder, together with the powder, into an earthen filter, with paper, and a linnen cloth over it: when the fluid is thus further ſeparated from it, and it is become of a proper conſiſtence, lay the powder on a board, or chalk ſtone, to dry.

Alum has been, alſo, uſed inſtead of the Epſom ſalt; and will afford a white earth, by the ſame treatment: but the two earths are very different in their nature.

*Note.*

This is the proceſs, by which the magneſia alba, ſold here during the vogue, in which this medicine was ſome time ago, was prepared, by ſome conſiderable dealers in drugs and chemical preparations, who pretended they imported it from Hamburg. This earth is not the ſame with that obtained from the nitre: but, for any thing that appears to the contrary, may anſwer the ſame end; as it is, by no means, evident,

there is any efficacy in either, which does ſolely lie in the alkaline quality, they poſſeſs, in common with all other cetaceous or teſtaceous bodies.

As the magneſia alba has been recommended, as having a cathartic power, on children, along with that of abſorbing acids, it is better not to free the earth from the ſalts, formed in the preparation, by any ſubſequent additions of water to it in the filter: for the ſalt produced, being the ſame with the ſal polychreſt, vitriolated tartar, &c. will contribute to the cathartic effect: or, indeed, muſt be the only cauſe of it; unleſs where the earth, meeting with a conſiderable quantity of acid, in the inteſtines of thoſe, who take it, may be converted into a neutral ſalt; which will, conſequently, have this power.

### *Spirit of ſulphur by the bell.*

Take any quantity of ſulphur; put it into an earthen diſh, placed upon an inverted crucible: ſet them both, upon the bottom of a large earthen veſſel, in a moiſt place, ſecured from the wind; and then fire the ſulphur with a red-hot iron; and hang over it a glaſs bell, at ſuch a diſtance as to be out of the reach of the flame; the vapour of the ſulphur will condenſe in the bell;

bell; and flow down the ſides of it, like water, into the veſſel underneath.

*Note.*

The ſpirit, thus obtained, will no way differ (as was before ſhewn p. 80) from pure oil of vitriol of the ſame ſtrength: and the acid, now ſold under that name, is, (as we have before ſeen,) prepared from ſulphur by parallel means. But, as the college of London have thought proper to give this proceſs; and, thereby, ſeem to intimate, the ſpirit of ſulphur, by the bell, may be eſteemed a different medicine, and, as, many from that authority, or their own attachment to former uſages, may chuſe to have ſpirit of ſulphur prepared in this manner, I ſhall ſubjoin a much more expedite and profitable method than the above, for conducting this proceſs, by increaſing the quantity of condenſing ſurface; and by determining all the fumes of the ſulphur to paſs into the condenſing veſſel; both which are wanting, when the common bell is uſed.

*An expedite and profitable manner of making the ſpirit of ſulphur by the bell, by means of the apparatus deſcribed p.* 48.

Put the glaſs plate over the mortar; and ſet the drinking glaſs, inverted, in the middle of

it: put, then, a proper quantity of ſulphur into the ſmall earthen diſh; and place it on the bottom of the inverted glaſs: ſuſpend the retort, over theſe other veſſels, in ſuch manner, that the plate, containing the ſulphur, may be put within the hole in the bottom of the retort; ſpace being left for the air to enter freely, on every ſide the diſh, into the cavity of the retort. The tubulated receiver muſt be then fitted to the retort, and the joint luted: after which the ſulphur muſt be fired; and the fumes will be condenſed into ſpirit; partly in the retort, which will drop thence on the plate, and run into the mortar; and, partly, in the receiver. When the quantity of ſulphur in the diſh is conſumed, it muſt be renewed; or, if, by accident, its fire be extinguiſhed before the whole be burnt away, it muſt be rekindled by means of a red-hot iron.

*Note.*

Thoſe, who are ſollicitous to have the ſpirit of ſulphur prepared by the regular proceſs, may eaſily procure it by theſe means: but it is not to be expected from ſhops or dealers; the oil of

of vitriol, diluted with water, being univerſally ſubſtituted for it: and, as they are, excepting accidental impurity, the ſame, there is no way of diſtinguiſhing the one from the other.

## *Lac ſalphuris.*

Take, of ſulphur, any quantity, of quicklime, thrice the weight of the ſulphur: boil them, till the ſulphur be diſſolved; and filter the ſolution through paper: make a precipitation with weak ſpirit of vitriol; which precipitation is to be made perfectly inſipid by frequent waſhings.

### *Note.*

This is the proceſs of the college of London; and directs a much cheaper and ſhorter method, than the old one of uſing ſalt of tartar inſtead of the lime.

It is, however, erroneous, with reſpect to the quantity of lime: as half the quantity, there preſcribed, or leſs, will be ſufficient to cauſe the ſolution of the ſulphur; with which intention alone, the lime is uſed; and, as, by thus increaſing the volume of the feces, (which the lime may be allowed to be called, after it has anſwered its purpoſe, in making the water diſſolve the ſulphur), the filtration of the ſolution

is rendered very tedious; and attended with a conſiderable loſs, from the quantity of fluid, which remains abſorbed, in the great maſs of lime, after it has been as well drained, as it can be in any moderate time. The following proceſs, therefore, may be conſidered as preferable to the above.

*Improved method of preparing the ſal ſulphuris.*

Take, of quicklime, ſeven pounds: put it, gradually, into a proper boiler, containing three or four gallons of water: when the lime is quenched in the water, add to them, of crude ſulphur, five pounds: and boil the mixture three quarters of an hour, or an hour: the ſulphur being, then, diſſolved in the water, filter the ſolution, through paper, in an earthen cullender; and, when the fluid is ſo drained from the lime, that the filter ceaſes to run freely, put water to it, in the filter, to drive through as much more as poſſible of the remaining part of the ſolution. To the ſolution, thus ſeparated from the lime, add oil of vitriol, or ſpirit of ſalt, very gradually, as long as it ſhall appear to have any effect on the fluid, by exciting any effervescence, or producing any turbid-

turbidneſs; and when the powder, which will be, by this means, precipitated, has ſubſided to the bottom of the veſſel, take away as much of the fluid, as can be poured off clear, by decantation; and free the powder from the remaining part, by filtering with the earthen cullender through paper, a linnen cloth being put over the paper: when all the fluid has drained from the powder in the filter, put it into a quantity of freſh water; and proceed, by decantation and filtering, as with the firſt quantity of fluid, till the powder be a ſecond time freed from all the fluid, except what its own maſs abſorbs: fill up the filter, then, with freſh water; and, when that is drained off, repeat the ſame: after which, lay the maſs to dry, on a proper board, in ſmall pieces.

*Note.*

By purſuing this method, more lac ſulphuris will be obtained, from any quantity of crude ſulphur, than when a greater proportion of lime is uſed: and the waſhing it, in this manner, will free it from the ſalts effectually. It is, however, very uſual to omit the waſhing: by which omiſſion, not only ſo much trouble is ſpared,

but a gain ariſes from the ſalts left behind, as they add to the weight: but this neglect may be eaſily perceived, by a roughneſs, that appears, from it, in the lac ſulphuris, on its being rubbed betwixt the fingers; as, alſo, by the abundance of ſhining particles, which may be ſeen in it.

It is too common, likewiſe, to adulterate this medicine by chalk, lime, calcined oyſter-ſhells, or other cretaceous bodies: which ſophiſtication, or any other, by heterogeneous matter, may be detected by the following means.

### *Method of diſcovering the ſophiſtication of lac ſulphuris.*

Take any quantity of the lac ſulphuris, that is ſuſpected; put into a crucible; and put a leſs crucible, reverſed, on the other, as a cover, but without any lute: place them in a common fire, where there is a ſufficient heat to ſublime the ſulphur: continue them there, till the ſulphur be wholly ſublimed; which may be perceived by the fumes ceaſing to ariſe. If the lac ſulphuris be pure, there will be no recrement, or caput mortuum, left in the crucible: but, if there be any adulteration, the matter of it will be left in the crucible; and, by weighing, or other proper trials.

trials, either its quantity, or nature, may be known.

### *Salt of amber.*

Take, of white amber, one part, of clean ſand, three parts: being mixt, put them into a glaſs retort, of which they will fill one half: then fit on a large receiver: and diſtill, in a ſand-heat, with a fire gradually increaſed: at firſt a ſpirit will come over, with ſome yellow oil; then a yellow oil; after which, the heat being increaſed, more ſalt will riſe, with a rediſh oil: when the diſtillation is over, empty the fluid out of the receiver; and, having collected the ſalt, which adheres to the ſides, dry it by a gentle preſſure betwixt the folds of ſpongy paper. The oil may be ſeparated from the ſpirit, by filtering; and afterwards rectified, by diſtilling it from ſome brine of ſea ſalt.

### *Note.*

This is the proceſs of the Edinburg diſpenſatory; and the beſt, upon the whole, hitherto given: but it is, nevertheleſs, improper in ſome particulars; and too inexplicit as to others.

The

The addition of ſand, in the diſtillation, is unneceſſary, and better omitted: for the only uſe of it, is to keep the melted amber from riſing over the neck of the retort: but a too great ebullition may be eaſily avoided, by the proper management of the fire; without which, the ſand itſelf will fail in preventing this conſequence.

The inſiſting on white amber, is without any ground: for, though that ſort be generally dearer than the other, yet the blacker kind ſometimes affords an equal, or greater quantity, of ſalt; and is, in other reſpects, exactly the ſame with relation to this preparation. The great ſecret in preparing this medicine cheap, does, indeed, lie in the choice of the amber; as ſome parcels afford, greatly, more ſalt than others: but this difference is not diſcovered, either by the colour, or any other apparent quality, hitherto known: on which account, the beſt way is, to try, by a moderate quantity, what any parcel will afford; and to purchaſe the whole, if it be found good; or otherwiſe to reject it, and try ſome other.

The retorts uſed, for this operation, ſhould be made with long wide necks, cut to a very large orifice; that the ſalt may be taken out before the brown oil ariſe; which may be done by a ſmall wooden ſpatula.

The ſalt, which comes after, along with the brown oil, may be put into the phlegm, that is improperly called the ſpirit, (being only water impregnate with the ſalt): and, this phlegm, being

being freed from the oil, and afterwards exhaled, in balneo mariæ, the remaining ſalt may be mixed with that, which was at firſt taken out of the neck.

The college of London, in their diſpenſatory, direct the ſalt to be boiled, either in the ſpirit, which comes over with it, or in water; in order to free it, more effectually, from the oil adhering to it; and even ſeems to intimate a repetition of this operation: but, as this cauſes an additional trouble in diſſolving the ſalt, and evaporating the fluid, to bring it back to a proper form; and tends, alſo, to a diminution of the quantity, as well by taking away the oil, as by the waſte, which this treatment will unavoidably occaſion, it is ſeldom practiſed: and, with regard to the perfection of the medicine, the omiſſion of this part of the preparation is, perhaps, rather meritorious, than condemnable: for it is a great queſtion, whether the ſalt of amber does not owe a principal ſhare of its efficacy, to the oil, which is mixt with it; and, certainly, if ſo, the cleanſing it, more than is done by means of ſpongy paper, may be rather a detriment than an improvement.

The ſalt of amber, being a very dear medicine, is very frequently adulterated: and the moſt uſual ſubſtances, with which it is ſophiſticated, are cremor tartaris and ſal ammoniacum.

But theſe frauds, or, indeed, any other, committed on this medicine, are eaſily detectable, by the following means.

*Method of detecting any adulterations of the ſalt of amber.*

Take a ſmall quantity of any parcel ſuſpected; and mix it with moiſt ſoap, of any kind. If it be adulterated with ſal ammoniacum, a ſmell of volatile ſalt will immediately be diſcernible: from whence the ſophiſtication, with the ſal ammoniacum, may be poſitively aſcertained.

If it ſtand this trial, and no pungency, like that of volatile ſalts, enſue, take another ſmall quantity; and lay it on a poker, heated almoſt red-hot: by which means, the ſalt of amber will be diſſipated in fumes; and the heterogeneous matter left behind: which, if it be cremor tartaris, will appear in the form of a black or coaly powder; if any other neutral ſalt, in a white one.

*Note.*

Theſe two experiments are fully concluſive, with reſpect to the genuineneſs of ſalt of amber; for it can be adulterated with nothing, that has a volatility in a degree near its own, except ammoniacal ſalts, which will, always, ſhew itſelf,

itſelf, by the appearance of a volatile pungency, on its admixture with the ſolution of fixt alkaline ſalt, either in ſoap, or any other way: and, if it be not adulterated with ſome body volatile, like itſelf, the application of that degree of heat, which will ſublime it, will, conſequently, ſeparate it from the ſophiſticating matter; and leave ſuch matter, ſubject to any further examination, which ſhall be thought proper.

### *Oil of amber.*

Take any quantity of the oil, as it comes over, in the diſtillation of the amber for the ſalt; and put it into a retort, with four times its weight of water: fit a large receiver to the retort; and give a heat, juſt ſufficient to keep the water boiling: continue the diſtillation, till a great part of the mixture be come over: when, the receiver being taken away, the rectified oil muſt be ſeparated from the water. If the oil of amber be deſired very limpid, the rectification muſt be repeated.

### *Note.*

The Edinburg college direct this operation to be performed with brine of ſea ſalt: but water will anſwer the end equally well; if the heat

heat be kept from riſing above the due degree; and the retort be made of a long form, having its neck placed ſo depending in the furnace, as to return a great part of what is condenſed in it again into the body of the retort.

Though the oil of amber be thrown away in great quantities, by thoſe, who make the ſalt; yet, to avoid the trouble of the rectification, it is very uſual to adulterate it by the admixture of the oil of turpentine: which it is very difficult to diſcover, unleſs by the ſmell. It is, however, a blameable practice; and ought to be guarded againſt; as the oil of amber has medicinal qualities different, at leaſt in the degree, from the oil of turpentine: and, tho' the latter will not in the leaſt counteract the intention of the former, yet it perverts the due proportion of the doſe; and eludes, in that reſpect, the deſign of the preſcriber.

The oil, diſtilled from coal, treated, for that end, in the ſame manner as amber, has been ſubſtituted for the oil of amber; and is ſaid to be the ſame: but at preſent the ſmall conſumption of the oil of amber, the plenty of it with thoſe, who prepare the ſalt, and the increaſe of it in the hands of others, by the addition of oil of turpentine, have taken away the temptation, which Wilſon, who introduced this ſubſtitution, might have, in his time, for practiſing it.

*Method*

*Method of making yellow arsenic.*

Take, of arsenic powdered, one pound, of flowers of sulphur, half a pound: mix them well, and sublime them, in a cucurbit, of an oval form, in the sand-pot designed for the sublimation of calomel; keeping up the fire as high as may be, without forcing out the fumes from the mouth of the cucurbit: when the whole is sublimed, which may be known by the abatement of the heat in the upper part of the cucurbit, the fire must be discontinued; and the cucurbit broken, when cold, to take out the cake of yellow arsenic.

*Note.*

This substance is not used in medicine; nor much for any purpose, but in the dying the colours called Saxon blue and green: for which, at one time, it was greatly wanted; and fetched from abroad, at a very considerable expence: to avoid which inconvenience to the public for the future, I have inserted this process, by which it may be made, with very little expence and trouble, here.

SECTION

## SECTION IV.

### *Of the preparation of thoſe medicines where metalline ſubſtances make the whole, or principal part of the ſubject.*

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*Purification of mercury.*

Diſtill the quickſilver, in a retort; and then waſh it well with water and ſalt, or vinegar.

*Note.*

This is the direction of the college of London. But the diſtillation of the quickſilver in a retort is hardly practicable: for the great heat, and denſity, of the fumes, when collected againſt the ſides of the neck of the retort, heat it ſo unequally, that it is ſcarcely poſſible to prevent its being cracked, and falling to pieces, during the operation: and there is, indeed, another reaſon againſt the uſe of a retort; which is, that a ſand heat is ſcarcely ſufficient to raiſe the fumes of the mercury into the depending part of the neck of them; and the uſing them coated, and in the naked fire, is attended both with much trouble and hazard. If, however, a retort be uſed, it ſhould be of a low round form; and placed ſo in the furnace, that

that the neck, which ſhould alſo be very ſhort, may be as depending as poſſible, that the quickſilver may not lodge in it; but fall, as it collects in drops, inſtantly into the receiver; which ſhould be half filled with water, before it be put to the retort. The method, below given, ſaves all this trouble; avoids the hazard; and may be performed any where, with a common fire, without employing a furnace.

The waſhing the quickſilver in ſalt and water, or vinegar, after the diſtillation, ſeems intirely needleſs and ineffectual; for the mercury will certainly be freed from any adulterate mixture, by the diſtillation: and, if it were not, the waſhing in brine, or vinegar, could not avail, in the leaſt, to that end.

*More expedite method of purifying quickſilver, by means of the alembic deſcribed p.* 43.

Take any quantity of quickſilver; and put it into the iron alembic, directed to be made for this purpoſe: the ſtopper being ſkrewed in to the hole at the top, place it on a culinary fire, raiſing the coals round it: let an earthen pot, filled with water, be ſo placed, that the bended end of the iron tube of the alembic may lie immerſed, two or three inches within the water; and

the fumes of the quickſilver will be then condenſed in the tube; and run down into the water: when the whole is diſtilled, which may be eaſily perceived by the quickſilver's ceaſing to drop into the veſſel of water, the ſtopper may be taken out; and the alembic repleniſhed at pleaſure, without taking it from the fire.

*Note.*

By this method, very great quantities of quickſilver may be diſtilled, without the leaſt trouble or expence: and this operation ought, therefore, to be always previouſly practiſed on the quickſilver, of which the ethiops mineral, alcalizate mercury, and precipitates of every kind, are prepared; or in caſe of any other preparation, where there is no ſubſequent ſublimation, in order to free the quickſilver from thoſe almoſt conſtant adulterations, that are made on it; and which may be diſtinguiſhed, by the method below given, where we treat of the ſophiſtication of ſimples; and the means of detecting them.

*Corroſive mercury ſublimate.*

Take, of purified quickſilver, forty ounces; of ſea ſalt, thirty three ounces, of nitre, twenty

twenty eight ounces, and of green vitriol calcined, ſixty ſix ounces: let the quickſilver be mixed, in a veſſel of ſtone, or wood, with one ounce, or more, of mercury ſublimate already made, and broken into ſmall grains: then let it be ground with the nitre, and afterwards with the ſea ſalt, till there be no longer any appearance of quickſilver: when add the calcined vitriol; in the commixture of which, with the others, the operation ſhould not be too much prolonged; leſt the quickſilver revivify, or reaſſume its fluid ſtate: laſtly, ſublime the mixture in a glaſs mattreſs; to which, at diſcretion, a proper head muſt be fitted, to ſave the ſpirit; of which a ſmall quantity will riſe.

*Note.*

This is the proceſs of the college of London; and one of the beſt for making ſublimate, by the means of green vitriol and nitre.

The greateſt difficulty, in this proceſs, is the fixing the quickſilver, in order to its commixture with the other ingredients; which is very troubleſome. An ounce of ſublimate, already made, and broken into ſmall grains, is ordered to be uſed for this purpoſe; but it is better to

take a greater quantity, to reduce it to powder, and to moiſten it with ſpirit of ſalt; by which means, this tedious operation may be much ſhortned.

The mattraſs, in which this ſublimation is to be made, ſhould not be quite half filled with the ingredients: it ſhould be placed in the pot, in ſuch manner, that the ſand may riſe round it a little higher than the part of it occupied by the contents.

But, though a mattraſs be here directed, large cucurbits, or bodies, of an oval form, are almoſt univerſally uſed; and with great reaſon: for, as only a ſmall quantity of ſublimate is produced from this great maſs of ingredients, if the veſſel, in which the ſublimation is made, be not capable of holding a conſiderable quantity of materials, not only the time, and fire, employed, in obtaining ſo minute a proportion, but the ſmall ſize of the cake of the ſublimate, render it very diſadvantageous. The large ſand-pot, and not that intended for the ſublimation of calomel, is, therefore, much better accommodated to this purpoſe: and the cucurbit ſhould be choſen, as large as the furnace will admit; (for glaſſes of this form may be blown of almoſt any magnitude; and it may be filled, to the height of three quarters, with the materials: the ſand being brought round it, ſomething higher than the contents.

But the uſe of the crude vitriol, in making ſublimate, is wholly unneceſſary: for it has no effect

effect in the process, but in discharging the spirit of nitre from the salt; which may equally well be previously done, as the Edinburg process directs; where a solution of the mercury is ordered to be made in spirit of nitre; and the salt produced brought to a dry state, and mixt with an equal quantity of sea salt, and then sublimed: by which method, the volume is greatly reduced; and the sublimate much less liable to be discoloured, or otherwise injured, in the operation.

There is, nevertheless, a much less expensive and troublesome way, even than this, by which the expence of the nitre, and the pains and cost of the operation, for extracting the spirit from it, may be wholly saved. The practice of it has been hitherto confined, I believe, to one place; by persons, who at present are attempting to monopolize this article, with some others: but, for the benefit of the public, I will here lay it open, in the most explicit manner, I can, with the attendant advantages; and particularly recommend it to those, who may erect works for the preparing oil of vitriol from sulphur.

*The most cheap and expedite manner of making the corrosive mercury sublimate, by the use of oil of vitriol, alone, with the quicksilver.*

Take, of quicksilver, twenty pounds; of oil of vitriol, nine pounds: having put them

together, in a retort; and placed it in a ſand-pot, diſtill till the fumes begin to appear white: take the maſs which will be found in the retort, and mix, with it, eighteen pounds of common ſalt; rubbing them together, till they appear as one body: put this maſs into a cucurbit, of which it will occupy ſomething leſs than three quarters of the cavity; and place it in a ſand-pot, to ſublime. When the ſublimation is finiſhed, take away all parts of the cake of ſublimate, which are not tranſparent, and white.

*Note.*

By this method, the whole proceſs is greatly contracted, both with regard to time, and the volume which the matter occupies in the ſubliming veſſel; and the ſublimate is much leſs liable to miſcarry, in the preparation, than when the crude vitriol and nitre are uſed: but if any diſcoloured parts ſhall happen to be found, they may be employed in making the white precipitate, as directed in the proceſs of the college of London; for which end, it will equally well ſerve, with that which is of the pureſt whiteneſs.

There is another ſource of profit opened, by this method of making ſublimate: for the whole

whole of the recrement, or caput mortuum, left behind in the retort after the ſublimation, is the true ſal mirabile, or Glauber's ſalt; and being taken out, and treated in the ſame manner, as the cake formed in the retort, when the regular proceſs for ſal mirabile is performed, (that is to ſay, diſſolved and chryſtallized,) it will, in all reſpects, be the ſame as if the oil of vitriol and ſea ſalt had been put alone into the retort. It may be proper, however, to put two or three ounces of pearl aſhes into the ſolution of this ſalt, before it be filtered previouſly to the chryſtallizing; and if the commixture of this alkaline ſalt produce a white turbidneſs, it will be proper to add another ounce of the pearl aſhes, and to repeat this addition, ſo long as it produces any cloudineſs, or till the ſediment, which it cauſes, become of an orange colour, or brown. The reaſon of this addition, is to analyze any ſublimate, which may remain unſublimed; or may have fallen from the cake, or the ſides of the cucurbit, in the taking it out, or breaking the glaſs: and which, by means of the alkaline ſalt, will have its elements diſunited; the mercury becoming a ſolid precipitate, and the ſpirit of ſalt, the other conſtituent, combining with the alkaline ſalt, and forming that ſalt, which the college of London have honoured, with a ſpecial proceſs, under the name of the ſal marinus regeneratus. If the deſtroying the prevalence of the acid, in the ſolution, by this commixture of alkaline ſalt

with it, ſhould render the chryſtallization weak, and tardy, an ounce or two of oil of vitriol, dropped into the ſolution, will take away any ſuch reluctance; and make the ſalt ſhoot as freely, as if no alkaline ſalt had been uſed. There will be gained, by this means, near a pound of Glauber's ſalt, for every pound of the ſublimate; which will defray the expence of the oil of vitriol, and glaſſes for the ſublimation; and, together with the great facility, this method affords for the preparation of ſublimate, renders it an article, which may be very advantageous to thoſe, who prepare medicines for wholeſale demands: eſpecially, if they undertake, likewiſe, to extract the oil of vitriol from ſulphur, by the new method: which, at preſent, would be found attended with great convenience, and profit, to all, who have large elaboratories; or a demand, either for uſe, or ſale, of any conſiderable quantity of that commodity.

It has been common to practiſe the moſt villainous ſophiſtication, with reſpect to ſublimate, which has ever hitherto diſgraced the morals of mankind, by adulterating it with a ſubſtance of the moſt poiſonous nature. I ſhall be ſilent here, as to any further explanation, either of what this ſubſtance is, or how it is to be employed for this wicked purpoſe; as I would not, on any account, be the cauſe of propagating ſuch deteſtable arts: but, inſtead of furniſhing thoſe, who are ignorant of it, with the method of practiſing this curſed ſophiſtication,

phiſtication, I will furniſh a method, by which any perſon may eaſily diſcover, where it has been made; and have it in their power to reject ſuch parcels of the ſublimate, as they find to be of this adulterate kind. This method is as follows.

*Method of detecting the adulteration of corroſive ſublimate.*

Take, a ſmall quantity of the ſublimate ſuſpected; and diſſolve it in boiling water: take, alſo, about double the quantity of any fixt alkaline ſalt, and make a clear ſolution of it: mix them together; and a precipitation will follow; from which, if it be immediately of a black colour, it may be concluded, that the ſublimate was adulterated in the manner ſuſpected; but, if it appear of an orange colour, it may be deemed free from any ſuch depravity.

*N. B.* The obſervation on the colour, as a criterion of this difference, muſt be made ſoon after the commixture: for the orange colour will ſometimes change to black, on ſtanding a conſiderable time, even in the caſe of the beſt ſublimate; if the fluid, in which

which the precipitation is made, abound with alkaline ſalt

### *Preparation of calomel.*

Take, of corroſive mercury ſublimate, one pound; of purified quickſilver, nine ounces: the mercury ſublimate being firſt powdered, put it, together with the quickſilver, into a glaſs mattraſs; and digeſt, with a ſlow heat, in ſand, the glaſs being frequently ſhaken, till they incorporate: then augment the heat, and ſublime them: powder the ſublimed matter, having freed it from the acrid upper part, and the globules of quickſilver, if any appear; and then ſublime it again: the ſublimation muſt be ſix times repeated.

### *Note.*

The repetition of the ſublimation ſeven times is rarely practiſed; three, or four, being the utmoſt, which are afforded in the elaboratories for ſupplying conſiderable quantities of medicines; nor can any reaſon be given, why that number, properly managed, may not reduce the calomel to the ſame ſtate, as ſeven hundred.

hundred. It is obvious, that all, which the heat can effect, is the equal mixture of the acid and mercury, which conſtitute the calomel; and the driving out any redundant part of the firſt: and, certainly, this may be more effectually done by other means, than the tedious repetition of this troubleſome and expenſive operation.

The purification of the mercury by ſublimation is, alſo, needleſs; for nothing, with which mercury can be adulterated, will riſe on the ſublimation. It is ſufficient, therefore, to prove it, by ſtraining a ſmall quantity through leather; and, if no paſte like amalgama be found remaining in the leather, but, that the mercury ſuffer itſelf to be wholly preſſed through, which proves that the proportion of the ſophiſticated matter, if there be any, muſt be only ſmall, there can be no inconvenience from uſing the mercury, though not pure, further than a proportionable defect of the produce of ſublimate: but even ſhould a greater adulteration be found, if ſome of the mercury be put in a crucible into a common fire, and continue there till it be diſſipated by the heat, and the caput mortuum weighed, in order to make a proper allowance in the compoſition of the ingredients, for the defect in the mercury ariſing from the ſophiſtication, ſuch mercury may be equally well uſed, as that which is abſolutely pure.

There is a flaky laminated appearance in calomel, the dealers in medicines value in it, which

which is owing to the greater proportion of mercury; and to the briſkneſs of the heat in the ſublimation. I ſuppoſe the reaſon for preferring this appearance, is from the experience of its moſtly attending that calomel, which they know has undergone, a great number of ſublimations: but as it is eaſily practicable, to diminiſh the quantity of the acid ſpirit in calomel, with a much leſs number of ſublimations, this appearance may, conſequently, be produced, as well as all the other qualities which are to be deſired in this medicine. The following method, in particular, will produce calomel by three ſublimations, indiſtinguiſhable, in all its properties, from the beſt that can be made by any repeated number whatever.

*More expedite method of producing perfect calomel, where the ſublimation is only three times repeated.*

Take, of corroſive mercury ſublimate, twelve pounds; of quickſilver, if pure, nine pounds; or, if otherwiſe, ſuch a proportion as may allow for the adulteration, which muſt be previouſly aſcertained: the ſublimate, being powdered, divide it into three equal parts; and put it, with a proportionable diviſion of the mercury, into three

three mattraſſes; and place them in a gentle ſand heat, ſhaking the mixture frequently; where they muſt continue, till they appear to be intirely incorporated: then put the whole together into one mattraſs, of which they will fill about one half; and place it in the ſand-pot, deſcribed p. 25 for this purpoſe; the mattraſs being immerſed in the ſand ſomething more than one half: let the matter be then ſublimed with a moderate heat; and, the ſublimation being finiſhed, break the glaſs; and, having taken out the ſublimed cake, ſeparate carefully all the yellow parts, if any be found; and levigate the other, but without moiſture, mixing with it two pounds of freſh quickſilver, rubbed to powder, firſt with half an ounce of ſublimate: repeat then the ſublimation and levigation as before, adding, at this ſecond levigation, only a pound of the quickſilver treated as before: ſublime then a third time; and levigate, but without any further addition of quickſilver; and afterwards give the fourth and laſt ſublimation, with the ſtrongeſt heat that can be uſed without blowing the fumes of the mercury out of the neck of the mattraſs;

traſs. Take out then any diſcoloured part; as, alſo, the upper part of the cake in the neck of the retort; if it appear any way to differ in its texture from the reſt.

*Note.*

The calomel, thus prepared, will be as perfectly free from any corroſive qualities, as any number of ſublimations whatever can render it: the colour will be perfectly white; and it will, alſo, have that flakey laminated appearance, which good calomel is ſuppoſed to require.

The fourth ſublimation may be ſpared, by thoſe, who prepare this medicine for ſale, if the other parts of the proceſs be duly executed: but, in that caſe, the third muſt be performed with the ſtrong heat directed otherwiſe for the fourth.

The yellow, or other rejected parts of the calomel, may be employed along with the crude mercury: in making ſublimate with oil of vitriol.

It has been too uſual to adulterate calomel, as well as ſublimate, with the poiſonous ingredient before mentioned; and I have ſeen a recipe, (given by a German empyric, who has for ſome few years infeſted this country, and pretends to knowledge in almoſt every branch of chemiſtry,) which directed this ingredient to be uſed in a very large proportion, which, if it happened to be joined to Venetian ſublimate, that ſhould contain, likewiſe, a large proportion

of the ſame ſubſtance, as is frequently the caſe, a poiſon, that ſcarcely the ſtrongeſt conſtitution could reſiſt, muſt have neceſſarily been produced. The preparers of medicines for the Weſt-India trade, have, likewiſe, adopted this execrable practice; and, on inquiry, for what purpoſe the matter of this adulteration was preparing, in a large quantity, the uſe of it, for this end, has been freely avowed; with the apology, that the calomel would be adminiſtered only to negroes. In order, therefore, to prevent ſuch dangerous preparations being impoſed on thoſe, who are duly careful, and that they may not be liable to give, perhaps, a ſcruple of ſuch calomel, as I have ſeen kill a dog in the quantity of three grains only, though fetched from the ſhop of a very great dealer in medicines, I will give an infallible method of detecting this pernicious fraud; as the means before directed, to be uſed for this purpoſe, with reſpect to ſublimate, are not practicable in the caſe of calomel, as it is not capable of being diſſolved in water.

*Method of detecting the adulteration of calomel.*

Take a ſmall quantity of the ſuſpected calomel: powder it with about a third of its weight of flowers of ſulphur: put the mixture into a crucible, over which a leſſer is to be inverted as a cover: place the crucible in a common fire, that it may have a heat ſufficient

cient to raiſe the ſulphur in fumes. If the calomel be adulterated, as ſuſpected, a very offenſive alliaceous ſmell, like that of orpiment, will be perceived: but if none ſuch be found to be produced, it may be taken for granted, that it is free from the mixture of the pernicious ingredient, uſed for its ſophiſtication. This adulteration may be, alſo, perceived, but with leſs certainty, by dipping a piece of the calomel, unground, into a ſolution of fixt alkaline ſalts; which, if it be ſophiſticate, will turn it black; but, if not, to an orange colour.

*Note.*

The frequent complaints of tormina, and ſometimes even bloody ſtools, which happen on the taking calomel, are probably more owing to this adulteration, either made, originally, in the preparation of the ſublimate, or, afterwards, in that of the calomel, than to any other cauſe. It is adviſable, therefore, always, when ſuch conſequences happen, to examine the calomel; and prove it, by this means: for, where the ſophiſtication happens to be in the ſublimate, the moſt careful and conſcientious preparer of the calomel may be deceived: and it is, therefore, very proper, alſo, that all, who do not prepare the ſublimate themſelves, which is the caſe of

of very few, ſhould examine it by the means above given: as there is no excuſe for placing a confidence in the preparations of foreigners; which are imported here in ſuch a manner, that it is impoſſible to trace back any ſophiſticate parcel, to the hands of thoſe who practiſed the fraud: and the invention of this monſtrous impoſition is of ſo old a date, that memoirs of it may be found of a hundred and fifty years ſtanding: from whence we may conclude it, to be very well known at preſent, in all places, where the manufacture of ſublimate has been long carried on.

### *White precipitate of mercury.*

Take, of ſal ammoniacum, and corroſive ſublimate, each an equal weight: diſſolve them together in water; and, having filtered them through paper, make a precipitation, with a ſolution of any fixt alkaline ſalt: waſh the precipitated powder till it be perfectly ſweet.

#### *Note.*

The uſe of the ſal ammoniacum in this proceſs, which is that of the college of London, is, we are told, to facilitate the ſolution of the ſublimate in the water; to which it is otherwiſe very reluctant: but it does not appear

pear to anſwer, in the leaſt, that end, when carefully tried: nor is there any difficulty in diſſolving the ſublimate, previouſly powdered, in a ſufficient quantity of boiling water: for, though a large proportion be required, yet that does not produce any inconvenience, in this operation, the removal of which might ballance the expence of the ſal ammoniacum.

The filtering the ſolution is likewiſe wholly unneceſſary, if the ſublimate and water be clean: nor is it even requiſite, when ſal ammoniacum is uſed; if foul pieces of the ſalt be not uſed without ſcraping.

The ſolution of the alkaline ſalt muſt be added, by degrees, to that of the ſublimate; and with great caution, when near the due quantity has been added: for, if a ſufficient quantity be not uſed, a part of the ſublimate will remain in the ſolution unprecipitated; and, conſequently, be waſted; and, if more than the proper quantity be uſed, the colour of the precipitate will be ſpoilt; as the ſmalleſt exceſs, in the proportion of the alkaline ſalts to the ſublimate, turns it yellow; and a greater quantity orange. It is proper, therefore, to reſerve ſome part of the ſolution of the ſublimate; which being added, may bring back the colour of the precipitate, if it be hurt by an error in this point; and by thus adding a little of each, as the effect of the commixture may indicate, the due ballance of them may be obtained with great exactneſs.

But,

But, notwithſtanding the college of London have directed this proceſs to be followed, in the making the white precipitate, the produce of which the college of Edinburg have diſtinguiſhed very properly by the name of the ſweet precipitate, there are ſome, who do not prepare it by this means; but perſue the former method, of preparing it with aqua fortis from the crude quickſilver; that being, all things conſidered, the cheapeſt method: as a pound of quickſilver, treated this way, will afford a fourth, or fifth more than its own weight; as the acid of the ſpirit of nitre, and of the ſea ſalt, employed in its preparation, remain combined with it; whereas, on the contrary, a pound of ſublimate will not afford three fourths of its own weight in precipitate; as it is deprived of its acid, by the uſe of the alkaline ſalt. There is, alſo, another reaſon, why this latter preparation ſhould be followed by thoſe, who make white precipitate for ſale; which is, that as the principal demand for it is made by the farriers, who uſe it as a kind of eſcarotic, if the other method be adopted, the produce will be rendered wholly unfit for their purpoſe: for the precipitate is ſo much deprived of its acid, in which alone the cauſtic quality of it conſiſts, that they may as well uſe minium, powdered tin, or any other metallic pulveriſed body. It was, therefore, very judicious in the Edinburg college, not to reject the old manner of preparation, as the London college have ſince done; but to retain that, and take in, likewiſe, the new one; diſtinguiſhing

them by the names of white, and ſweet precipitate; as their qualities are eſſentially different; and theſe names properly ſignificant of that difference: the white meaning the old kind, which is in ſome degree corroſive, and, therefore, proper to be uſed externally, and for the purpoſes of the farriers; the ſweet meaning, that it is devoid of any ſaline nature, or cauſtic quality, and, conſequently, fit for internal uſe. The old proceſs ought, therefore, certainly, to have a place, as well as the new; and may be beſt performed in this manner.

*Moſt expedite method of preparing white precipitate of mercury, by means of ſolution in ſpirit of nitre.*

Take, of quickſilver, and pure ſpirit of nitre, each equal quantities: put them into a mattraſs, with a long neck; and place it in a ſand heat of digeſtion: where let it ſtand, often ſhaking the ingredients together, till the mercury appear to be perfectly diſſolved, or rather converted into a white ſalt; for this proportion of fluid will not be ſufficient to keep diſſolved, the ſalt produced; at leaſt, when not of a boiling heat: let the mattraſs, therefore, be removed to a degree of heat ſufficient to make it boil, a

ſmaller

ſmaller mattraſs being put with its neck inverted, into that containing the ſolution; and there continued till the ſalt appear to be wholly diſſolved; which, if it cannot be performed without a greater proportion of fluid, muſt be effected by the addition of a ſmall quantity of hot water; that muſt be added, by degrees, till no ſolid maſs appear to be left in the mattraſs. A ſtrong brine muſt then be made of ſea ſalt, by pouring hot water on common ſalt, in the proportion of five pints to two pounds; and when the ſolution of the ſea ſalt is cold, the ſolution of the mercury while, yet hot, muſt be poured into it; the proportion of brine uſed, being two pints to every pound of quickſilver contained in the ſolution: the quickſilver will then be ſoon precipitated, and ſubſide to the bottom; leaving the fluid clear above it; which as ſoon as it appears ſo, muſt be poured off; and an equal quantity of freſh water, or more, if the veſſel will contain it, added to it: this ſecond quantity muſt, likewiſe, be poured off, from the precipitate, as before; not

ſuffering it to ſtand longer, than till it become clear by the ſubſiding of the precipitate. The remaining fluid, and ſediment, muſt then be put into the cullender filters, with paper covered with a linnen cloth; and when the fluid is drained off, and the precipitate left of a due conſiſtence, it muſt be laid out, on a proper board, to dry, in ſmall lumps, in the ſhade.

*Note.*

The deſign of the precaution of making ſaturated ſolutions, both of the mercurial and ſea ſalt, is, to prevent the loſs, which, otherwiſe, happens from part of the quickſilver remaining diſſolved; as the precipitated matter is, in fact, itſelf, in a ſaline ſtate, and quits the fluid, rather from the defect of a ſufficient quantity to keep it diſſolved, than from its being rendered of an indiſſoluble nature: and, for the ſame reaſon, the water muſt be ſparingly uſed in waſhing off the ſalts; and not ſuffered to ſtand long upon the precipitate. The great carefulneſs, in this point of waſhing, which the Edinburg college ſhow, when they direct freſh quantities of water to be added, till it come off without any acrimony, is exerciſed without any adequate object: for as the fluid, after the precipitation, is made, contains nothing but nitre and ſea ſalt, beſides the precipitate, there can be

be no acrimony in queſtion, but that, which is in all ſea ſalt, and nitre, in their proper neutral ſtate; and, therefore, none which can give any injurious qualities to the precipitate, even when internally taken.

The white precipitate is very rarely to be found without great adulteration; as few perſons take the trouble of preparing it, but thoſe, who make chemical medicines in great quantities. The moſt uſual ingredients, mixed with it, are white lead and ſtarch: the white lead being uſed, for the ſake of its weight, and the ſtarch for its whiteneſs: and ſuch kind of practices have become ſo general, with reſpect to this ſubject, that I have ſeen an eminent vender of drugs, and chemical preparations, reject a parcel of genuine white precipitate, on account of its being greatly heavier, than what he had been accuſtomed to be ſupplied with; though the weight is an unqueſtionable mark of its being really unadulterated. The certain means, however, of detecting any ſuch fraud, practiſed, in the caſe of the white precipitate, are, however, very eaſy; of which this method is one.

*Method of detecting adulterations of the white precipitate of mercury.*

Take any quantity ſuſpected; and put it in a crucible, with a third of its weight of

any fixt alkaline ſalt: place the crucible, in fire, where the matter in it may be heated red-hot: let it continue there, while any fumes ariſe: then take it out; and examine if there be any appearance of melted metal at the bottom; if not, put the reſiduum, or caput mortuum, left in it, into boiling water; obſerving whether the water diſſolve the whole of it or not.

If there be any appearance of melted metal remaining in the crucible, or, if the other matter found in it, do not diſſolve in the boiling water, it may be concluded, that the precipitate was adulterated, either with ſome metal, or earth, in the ſame proportion: for the mercury being ſeparated, by the action of the alkaline ſalt, from the acid, would of courſe be diſſipated in fumes; and the acid would combine with the alkaline ſalt, and from the vitriolated tartar; ſo that, if the precipitate were genuine, there could be no metal, nor earthy body remaining: and whatever of ſuch kind ſhould appear to be found in the crucible, with the caput mortuum, which ought to be wholly

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of a ſaline nature, muſt neceſſarily have been mixt with the precipitate in order to its adulteration.

The addition of ſtarch, to the white precipitate, may be perceived by the lightneſs of the maſs; and may be demonſtrated, by putting a ſmall quantity of what is ſuſpected, on a red-hot poker, or into a crucible, with another ſmaller one inverted into it, and heated in the fire; which will reduce the ſtarch to a coal, if there be any; and render it palpably diſcernible.

### *Red precipitate of mercury.*

Take, of aqua fortis, ſixteen ounces, of ſea ſalt, one dram: diſtill off the ſpirit ſo long as any will riſe.

In the compound aqua fortis, thus produced, diſſolve an equal weight of purified quickſilver; and, being evaporated, calcine them in a ſand heat, till the dried maſs has acquired a red colour.

### *Note.*

This is according to the proceſs of the college of London; but, on experiment, the method

thod will be found defective in ſeveral reſpects; and whoever, therefore, would manage this preparation advantageouſly, muſt perſue better means.

In the firſt place, aqua fortis, compounded with a ſmall quantity of ſpirit of ſalt, is ordered inſtead of pure ſpirit of nitre. The aqua fortis itſelf, which muſt be underſtood to be that made according to the proceſs of the college, is a compound, alſo, of oil of vitriol and ſpirit of nitre: for, from the proportion of vitriol uſed in the preparation, if the diſtillation be made with a ſtrong fire, a conſiderable quantity of the oil of vitriol will neceſſarily be raiſed with the ſpirit of nitre; ſo that the menſtrum, employed for diſſolving the quickſilver, is a mixture of the three acid ſpirits of vitriol, nitre, and ſea ſalt; which have no joint operation on the quickſilver, but each combining with its proper portion, will produce the reſpective ſalt ſuch combination forms. It is ſaid, however, that the addition of the ſea ſalt is neceſſary to form that ſparkling appearance, which is eſteemed in the red precipitate: but this can be no way owing to the effect that ſuch ſalt may have on the quickſilver itſelf; for, tho' the oil of vitriol in the aqua fortis, or even the ſpirit of nitre, if there were no oil of vitriol, would let looſe the ſpirit of the ſea ſalt, which, if the quantity of quickſilver added were as much as the whole of the acid could diſſolve, would form a proportionable quantity of ſublimate, yet the quantity of oil of vitriol,

and

and ſpirit of nitre, being greater than ſufficient to diſſolve the whole quantity of quickſilver, the ſpirit of the ſea ſalt would be prevented, by the ſuperior attraction of the others, from combining with any part of the quickſilver; and would, conſequently, be raiſed in vapour, and diſſipated in the evaporation of the ſolution, previous to the calcination of the precipitate: and were, really, any quantity of ſublimate formed, that would likewiſe be raiſed in the calcination, and fly off in fumes, without any effect on the remaining matter. If the ſea ſalt were, indeed, added to the aqua fortis, and no ſubſequent diſtillation of the acid ſpirit made, the ſmall quantity of ſal mirabile, produced by the combination of the vitriolic acid with the alkaline baſis of the ſea ſalt, might add to the ſparkling appearance of the red precipitate; as the ſalt itſelf powdered in the ſtate it would be here found, has a ſparkling appearance; but this is wholly put out of queſtion, by the expreſs direction, given in this proceſs, for diſtilling the aqua fortis, after the addition of the ſea ſalt, though, as I preſume, from ſome miſtake. The only effectual difference, therefore, betwixt the uſe of the pure ſpirit of nitre, and this compound aqua fortis, muſt appear to be, that a part of the mercurial ſalt, formed in order to produce the red precipitate by the ſubſequent calcination, muſt be compounded from the vitriolic acid in the aqua fortis, and, conſequently, be the ſame, as that from whence the turpeth mineral is, by a ſimilar calcination, pro-

duced; which being only a white maſs, unleſs converted into a yellow one by the addition of water, muſt weaken the red colour of the precipitate; and change greatly its medicinal qualities; and that, not in any certain proportion, but as the vitriolic acid ſhall happen to abound more or leſs in the aqua fortis, according to the degree of fire uſed in the diſtillation of it, or other attendant circumſtances. It is, therefore, much better, with reſpect to the medicinal intention, to uſe pure ſpirit of nitre, in the preparation here adviſed, from whence one regular effect may be obtained: and, with reſpect to the beautiful appearance, ſo neceſſary to the ſaleable condition of this medicine, it will be found equally advantageous, when conducted in the manner below directed.

*Improved proceſs for making the red precipitate of mercury.*

Take, of quickſilver, and pure ſpirit of nitre, equal quantities: put them into a mattraſs, with a long neck; and place them in a digeſting heat; ſhaking the mattraſs frequently, till the quickſilver be wholly diſſolved, (that is to ſay, converted wholly into a tranſparent fluid; or partly into ſuch fluid, and partly into a maſs of white ſalt): put this ſolution, and ſalt, into a long

long ſmall cucurbit; and place it in a ſand heat, where the bottom of the cucurbit may receive a conſiderable heat: fit a proper glaſs head, and receiver, to the cucurbit; and diſtill off all the fluid that will come over: when the fumes appear to riſe very ſparingly, take off the head of the cucurbit; and, by ſome proper inſtrument, draw out ſome of the contents, which will now be the red precipitate; and examine, if, on cooling, it appear of a fine red colour; in which caſe, lay a tile on the mouth of the cucurbit, and raiſe it gradually in the ſand, ſo as to prevent its ſuffering any longer the action of a ſtrong heat; but, if, on the examination, it appear of a yellow, or orange colour, and not ſo crimſon as it ought to be, on comparing it with a proper ſpecimen,) which ſhould be always had, in order to the forming a better judgment,) the head ſhould be put again on the cucurbit, but without the trouble of luting, and the heat ſhould be continued again for ſome time, till, on further examination, by the ſame means, the precipitate be found to be

of

of the proper colour: when, the cucurbit having been immediately raiſed out of the great heat, and ſuffered to cool, the contents muſt be taken out; and broken into an equal groſs powder; but not levigated, or reduced to a finer ſtate.

*Note.*

By this method, the red precipitate will not only be made as cheap, and equally beautiful, in its appearance, as with the trouble of the ſubordinate proceſs for the compound of aqua fortis; but its medicinal qualities will be always ſimilar and equal, both in the nature and force, of their operation; which is certainly of great conſequence at preſent, as this preparation is uſed internally by many, and even given very freely, with reſpect to the largeneſs of the doſe: whereas, when aqua fortis is employed in the preparation, in the place of ſpirit of nitre, an uncertain quantity of turpeth mineral will, of courſe, be produced: and, in many caſes, may operate in a manner very contrary to the intention of the medicine.

It is neceſſary, that pure quickſilver be employed as well for this, as the other precipitates.

The particular appearance of red precipitate, both with regard to its bright red colour, and the ſparkling particles, it ſeems to be compoſed of, prevent it from being ſo frequently adulterated, as it otherwiſe would be: but it is, never-

nevertheleſs, ſometimes ſophiſticated with red lead, finely levigated, and mixed with cinnabar, or vermilion; which, together, imitate the colour nearly enough to deceive any, who have not an exact remembrance of the red precipitate. Where the ſparkling appearance, or bright colour, therefore, ſeem wanting, and there is any reaſon to ſuſpect a fraud of this kind, a ſmall quantity, of the parcel ſuſpected, may be put into a crucible, with a little charcoal duſt: and covered by means of another leſſer crucible inverted; and, being expoſed to a heat ſufficient to fuſe lead, and continued ſo for ſome time, the red lead, if there be any, will be reduced; and regain its proper metalline form: and, if another quantity be put on a red-hot poker, the immediate ſublimation of the cinnabar, in copious fumes, will readily betray its preſence; if the red precipitate in queſtion has been ſophiſticated with it.

*Yellow emetic mercury, or turpeth mineral.*

Put any quantity of quickſilver into a glaſs; and pour on it double its weight of oil of vitriol: heat the mixture, by ſlow degrees, till it boil; and continue it in that ſtate, till only a white maſs be found at the bottom; which, the fire being increaſed, muſt be made perfectly dry: this maſs,

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on the pouring water on it, will immediately turn intenſely yellow; and fall to powder: let it be ground with this water, for a conſiderable time, in a glaſs mortar; and, after the powder has ſubſided, the water muſt be poured off; and ſucceſſive quantities added, till it be intirely ſweet.

*Note.*

The proportion of the oil of vitriol to the quickſilver has always been very erroneous, in all the proceſſes given for this preparation. The college of Edinburg direct four to one: and the college of London, in the proceſs here given, though they have ordered only half that quantity, have yet, nevertheleſs, more than doubled what is really neceſſary to be uſed. This will appear evident on the leaſt conſideration, that the adding more oil of vitriol to the quickſilver, than can act on it, muſt be entirely needleſs: and leſs than the proportion of acid, contained in an equal quantity of the oil of vitriol, is ſufficient to form the quickſilver into a perfect ſalt; as we ſee in the caſe of ſpirit of nitre, in the preparation of the red precipitate; after which neutralization, no further change can be made by any operation of the acid on it. No more oil of vitriol ſhould, therefore, be uſed than will combine with the quickſilver; for though, at the preſent price, the waſte is a matter

matter of no great conſequence; yet the tediouſneſs of bringing over ſo great a quantity of oil of vitriol, that requires a very ſtrong heat to raiſe it, and is with difficulty, indeed, brought over at all, in a ſand heat, together with the neceſſity, which the redundant acid, that will remain with the calx, when this quantity is uſed, produces of waſhing the turpeth with ſeveral freſh quantities of water, to the loſs of a conſiderable part of it, are very ſtrong objections, againſt the wantonly employing more than the due preparation of the medicine makes requiſite.

The pouring ſucceſſive quantities of water on the calx, is, likewiſe, both needleſs, and waſteful: for almoſt the whole quantity of the turpeth might, in time, be waſhed away by this means; the quickſilver, being, in fact, reduced to the ſtate of a ſalt, though of a kind very difficultly ſoluble.

The end of this waſhing cannot, therefore, properly be any other than the freeing the calx from any redundant acid; which may be, to a certain degree, much better done by employing ſo great a heat in the calcination, as may drive off all the acid, that is not fixed by the quickſilver; after which, the edulcoration may be ſufficiently perfected by ſuch an ablution, as will make very little waſte of the turpeth: the following proceſs will, therefore, afford a greater produce of turpeth equally good: though prepared with leſs expence, and much leſs trouble.

*More expedite and profitable method of preparing the turpeth mineral.*

Take, of purified quickſilver, and oil of vitriol, equal parts: put them into a retort, with a low neck; and place it in a ſand heat: diſtill off all the fluid, which will come over; urging it at laſt with a very ſtrong heat: take the maſs, which remains, after the diſtillation, in the retort, and break it to powder; water being poured on it; which will immediately convert it, from a white to a yellow colour: let it be well ground with this water, which muſt be afterwards, the powder having ſubſided, poured off from it; and a freſh quantity ſupplied; the ſame ſubſequent treatment being repeated: the powder muſt be then freed, from the remaining fluid, by putting it into a proper filter with paper, and a linnen cloth; and afterwards dried on a board.

*Note.*

The quickſilver ought to be proved, before it is uſed for this purpoſe; and, if any adulteration be found, it ſhould be purified by diſtillation.

lation. It is very rare, that the turpeth is attempted to be adulterated: becauſe the price of it is not great; and no other matter could be commixt with it, which would not deprave the colour, or diſcover itſelf by other appearances. The beſt method, therefore, of guarding againſt any impoſition, with reſpect to this medicine, is to have a ſpecimen of ſuch as is perfect at hand; and to compare any ſuſpected parcel with it; which, if it differ not in the bright yellow colour, may be with certainty concluded to be unſophiſticated.

## *Precipitate per ſe.*

Let purified quickſilver be placed, in a ſand heat, for ſeveral months, in a proper glaſs, with a ſmall hole, by which the air may have acceſs; and let it remain, in that ſtate, till it be calcined into a red powder.

### *Note.*

This will be much ſhortned by performing it in the glaſs deſcribed p. 49; where, by the greatly increaſing the ſurface of the mercury, and promoting the influx of air by the tubes inſerted in the lower part of the glaſs, the operation will be greatly accelerated: but, in this caſe, the glaſs muſt not be ſurrounded with ſand, but placed in a ſituation where the bottom of it may be heated to a proper degree,

without any ſolid medium ſurrounding it, which is no way neceſſary.

As the keeping a conſtant ſand heat, for the effecting this proceſs, which requires ſo great a length of time, would be attended with great expence, and trouble, it is much better to procure the glaſs to be placed in a proper hole in ſome of the outward parts of a glaſs-maker's, or malt-diſtiller's furnace, where it will undergo a due heat: and by this method, the operation will be equally well performed; and all the expence, and trouble, of keeping a fire, on purpoſe, intirely ſaved.

## *Æthiops mineralis.*

Take, of flowers of ſulphur, and of purified quickſilver, each equal quantities; grind them well together, in a glaſs mortar, till they be incorporated into a black powder.

### *Note.*

The moſt uſual ſophiſtication of this medicine is, by increaſing the quantity of the ſulphur; which may be diſcovered by revivifying the mercury by diſtillation; or, with leſs trouble, by boiling two or three ounces, or any known quantity, of the ſuſpected parcel, in ſoap lees; by which means, the quickſilver being ſeparated, it may be weighed; and its proportion to the quantity it was extracted from known.

known. This will, likewiſe, diſcover if it be adulterated by any other mixture; for, the ſulphur being diſſolved in the lye, and the quickſilver reduced to its metalline ſtate, the other heterogeneous matter will of courſe be diſtinguiſhable.

There is a method for the preparation of æthiops mineralis ſometimes practiſed, to ſave the trouble of grinding them together, till they incorporate; which is as follows.

## *Quicker method of preparing the æthiops mineralis.*

Take, of quickſilver, and ſulphur, equal parts; melt the ſulphur, taking care that it do not take fire: when melted, add to it the quickſilver, very gradually, ſtirring them well together: and, if the mixture take fire, from their effervescence, extinguiſh it immediately, by throwing a wet cloth over the veſſel: when the mixture is cold, levigate it.

### *Note.*

This is, by ſome, thought a ſhorter, and better, method than the other, of mixing the ingredients of the æthiops mineralis: but there is very little, if any, trouble ſaved by it; and

it is very dubious, whether the qualities of the medicine may not be altered by this method of preparation; eſpecially, as it is impoſſible to reduce the maſs of the united quickſilver, and ſulphur, to ſo fine a powder, by any mechanical method of levigation, as the other will be, neceſſarily, from the manner, in which the parts of the ſulphur are divided, by the ſublimation, in the forming it into the flowers.

### *Fictitious cinnabar.*

Take, of purified quickſilver, twenty five ounces; of ſulphur, nine ounces: melt the ſulphur; and add the quickſilver to it; and, if the mixture take fire, extinguiſh it by covering the veſſel: afterwards, let the maſs be reduced to powder, and ſublimed.

#### *Note.*

This ſublimation ſhould be performed in a coated body of glaſs, hung in the naked fire: the ſufficiency of a ſand heat being very precarious.

The quantity of ſulphur, here directed, is larger than has been generally preſcribed, when this preparation has been intended for medicinal uſe: but the far greateſt part of the fictitious cinnabar, being deſigned for the purpoſes of painting, where it is uſed under the name

name of vermillion, both the augmentation of the profit, from the low price of the ſulphur, and the improvement of the colour, have induced the preparers to enlarge the proportion of ſulphur to at leaſt one third.

The flowers of ſulphur, though not directed in this proceſs of the college, ſhould always be uſed: for, if the roll ſulphur be ſubſtituted, in the place of them, and ſhould happen to be adulterated, as is very frequently the caſe, with coarſe reſin, the beauty, at leaſt, of the cinnabar would be vaſtly impaired.

The manner of ſublimation is, likewiſe, of great conſequence, to the fine colour of the cinnabar; the producing which is a profitable ſecret to thoſe, who manufacture the vermilion: it lies principally in raiſing the fumes of the cinnabar ſo quick, that no part may ſettle in flowers; but the whole form itſelf according to that ſpecific texture, which appertains to this ſubſtance; in which particular, it correſponds with ſalts, that if condenſed in ſuch a degree of heat, as ſuffers the particles to coaleſce as they would in a fluid ſtate, form chryſtals; but if, in a leſs, they ſettle without exerting their ſpecific attraction, and become only that kind of powder we call flowers. The following method may, therefore, be advantageouſly perſued, where cinnabar is prepared as vermilion; and, for medicinal purpoſes, its difference, from that of the college prepared according to the proceſs above, will not be very material; as there are no data, from

whence we can draw any concluſions, what proportion of the quickſilver, and ſulphur, would produce the moſt efficacious medicine.

*Method of preparing cinnabar, particularly with a view to the forming vermilion of a very beautiful colour.*

Take, of quickſilver, eighteen pounds, of flowers of ſulphur ſix pounds: melt the ſulphur in an earthen pot; and pour in the quickſilver, very gradually; ſtirring them together with a tobacco-pipe; and, if, from the effervescence on adding the laſt quantity of the quickſilver, they take fire, immediately extinguiſh it by throwing a wet cloth over the veſſel: when the mixt maſs is cold, powder it; ſo that the ſeveral parts ſhall be well mixt together; but it is not neceſſary to reduce it by levigation to an impalpable ſtate: having then prepared an oblong glaſs body, by coating it well with fire lute, over the whole ſurface of the glaſs, and working a proper rim of the ſame round it, ſo that it may hang in ſuch manner, that one half of it may be expoſed to the fire within the cavity of the furnace, let the powdered

maſs be put into it, ſo as to fill the part, that is within the furnace; and a piece of broken tile be laid over the mouth of the glaſs: ſublime the cinnabar then, with as ſtrong a heat as may be uſed without blowing the fumes of the cinnabar out of the mouth of the glaſs; and, if there be any danger, that the ſublimed cake ſhould form itſelf ſo in the mouth, as to ſtop up all vent, lift up the tile at proper intervals; and, with the end of a tobacco-pipe, preſerve ſome paſſage, leſt, on too great an augmentation of the heat, the confined vapour ſhould burſt the glaſs: when the ſublimation is over, which may be perceived by the abatement of heat in the upper part of the body, diſcontinue the fire; and, when the matter contained in the glaſs is cold, take it out; and ſeparate from it, any part, which appears diſſimilar to the reſt: powder then the perfect part which is deſigned to be uſed, as vermilion; and keep what may be neceſſary for medicinal uſes, in lumps of the ſublimed cake.

*Note.*

*Note.*

The vermilion ſhould be levigated as finely as poſſible: for nothing contributes more to its beautiful colour, as well as its excellence in other reſpects, than the fineneſs of its powder. It is generally levigated by means of a hand mill, where conſiderable quantities are manufactured; but it may be rendered more impalpable, by the uſe of the muller and levigating ſtone, than any mill can effect.

The cinnabar, deſigned for medicinal uſe, ſhould be procured by thoſe, who uſe it in an unlevigated ſtate; and powdered by themſelves, to prevent the ſophiſtication, by red-lead, ſo frequently practiſed, where it is ſold in the ſtate of powder. This fraud is greatly perſued by the dealers in vermilion; as it is difficult to diſtinguiſh by the appearance, or immediately even in the uſe of it, the adulterate from the pure; but it is very injurious to the qualities of the paint, made of it; for, whereas the genuine vermilion would retain its beauty a long time; the red-lead, on the contrary, ſoon turns black; and, when mixt with the other, conſequently, ſoon deſtroys its brightneſs.

This ſophiſtication may, however, be eaſily detected by very ſimple means, in the following way.

*Method*

*Method of detecting the adulteration of cinnabar, or vermilion, by the admixture of red-lead.*

Take a ſmall, but known, quantity of the cinnabar, or vermilion, ſuſpected to be adulterated; and put it into a crucible; having firſt mixt with it about the ſame quantity, in bulk, of charcoal duſt: put the crucible in a common fire; having covered it with another leſſer crucible, inverted; and give a heat ſufficient to fuſe lead: when the crucible, being taken out of the fire, ſhould be well ſhaken by ſtriking it againſt the ground. If the ſuſpected adulteration has been practiſed, the lead will be found, reduced to its metalline ſtate, in the bottom of the crucible; and, being weighed, and compared with the quantity of cinnabar put into the crucible, the proportion of the adulteration may be thence certainly known: but, if no lead be found in the crucible, it may be ſafely inferred, that no red-lead had been commixt with the cinnabar.

*Note.*

*Note.*

The adulteration of cinnabar, by red-lead, may be diſcovered, if in a greater degree, by the comparing the ſuſpected parcel, with a ſpecimen of the pure: for though the red-lead does not greatly take off from the brightneſs of the colour of the vermilion; yet it gives a tinge of orange colour to it, not found in the genuine; which will, conſequently, appear different from the adulterate, by its more crimſon hue.

*Cinnabar of antimony.*

Take, of antimony, one pound, of corroſive ſublimate, two pounds: powder them ſeparately; and let them be thoroughly mixed, and diſtilled, in a ſand heat; being contained in a retort, whoſe neck muſt be large: ſublime what remains, in the retort, in a coated mattraſs, placed in the open fire.

*Note.*

The proportion of ſublimate here directed, in this proceſs, which is that of the college, differs from thoſe preſcribed in the former proceſſes: but it is, probably, with a view to the antimonial cauſtic that is produced along with the cinnabar, they have made this deviation;

tion; for the quantity of cinnabar will be diminiſhed, to the loſs of the preparer without any demonſtrable, or even rationally preſumptive improvement of the medicine.

The proceſs is, likewiſe, contrary to the former practice, divided into two operations; the firſt for diſtilling the butter of antimony, or antimonial cauſtic, in a retort, with a ſand heat; the other for ſubliming, in a mattraſs, the cinnabar, being the caput mortuum, or recrement remaining after the diſtillation; inſtead of performing the whole together, in a coated retort, in the naked fire. Where large quantities are to be prepared, this is certainly the more expedient method; for, when both operations are performed in the ſame veſſel, the cinnabar butter, are very apt to be commixt with each other, and the retort extremely liable to be cracked by the augmented heat, required for ſubliming the cinnabar.

But though the ſubſequent ſublimation of the cinnabar, in a diſtinct veſſel from that in which the butter is diſtilled, may be conſidered as an improvement; yet the choice of a mattraſs, as the proper veſſel for it, is certainly a great error; as the round figure of a mattraſs, though very ſuitable to ſome kind of ſublimations in ſand-pots, is by no means convenient for ſuch glaſſes, as are fixed in the cavity of the furnace itſelf; the nearneſs of the uppermoſt part above the fire to that which muſt be ſurrounded by it being ſo great, that it is impoſſible to give the due ſubliming heat to the one, without rendering

rendering the other hotter than the degree proper for condenſation; and, therefore, either the heat muſt be ſo ſuppreſſed, that the operation cannot be duly advanced, or the fumes of the ſubliming matter would be driven out of the neck of the veſſel; or, collecting in it, choak up the vent, and burſt the glaſs. A body, therefore, of oblong form, which admits of a due diſtance betwixt the upper and lower parts, as well as of the room neceſſary for the rim of lute, by which it muſt be hung, is far preferable: but, if the quantity be not great, it is proper to have ſome kind of dome, or cover, to the furnace, by which the body may be hung; ſince it would, otherwiſe, be unavoidable, to uſe a large body; as no other could be fixed in a common fized furnace: and this would render the ſublimed cake of cinnabar ſo thin, as not to have the ſalable appearance.

This cover, or dome, for hanging the ſubliming veſſel, may be a flat rim of caſt iron laid over the furnace, and contracting the opening into it, to the wideneſs proper for the purpoſe, ſo as to ſuffer the coated body, to hang upon it, by the rim of lute worked round it for that end.

The trouble and expence of making the cinnabar of antimony from crude antimony, and ſublimate, (the butter, or antimonial cauſtic, the other produce of this operation being ſeldom called for,) have occaſioned the ſeeking other methods of preparing it; as well as ſubſtitutions of other kinds of cinnabar

bar for it: amongſt which, the following is the oldeſt, and has been the moſt practiſed.

*Common preparation of cinnabar of antimony, without the mercury ſublimate.*

Take, of crude mercury, thirteen ounces; of flowers of ſulphur, five ounces, and of crude antimony, one ounce and a half: mix them well together; and ſublime them, in a coated veſſel, in a naked fire.

*Note.*

Though this has been vainly ſuppoſed to differ from other fictitious cinnabar, by the addition of the antimony: yet it is in every reſpect the ſame; the antimony not being any way analyzed, or yielding any part of its ſulphur to the mercury, by this treatment. And, indeed, if the cinnabar be prepared with this proportion of ſulphur, it will not have, in the leaſt degree, that appearance, which diſtinguiſhes the cinnabar of antimony from common fictitious cinnabar: the firſt being formed in long needles like ſhoots, which ſeem regularly joined to each other, in a parallel direction; but the latter, in ſhort irregular ſtria, and of a much more compact, and leſs friable texture.

This irreſemblance may, however, be avoided; and a cinnabar prepared, by better adopting the proportion of the quickſilver and ſulphur to this purpoſe, which will be indiſtinguiſhable from the true cinnabar of antimony made with ſublimate, according to the above given proceſs; and without the uſe of any antimony at all; of which, however, a ſmall quantity may be put in to ſave the honour of thoſe, who are ſcrupulouſly nice in the manner of deceiving.

The following is the moſt expedite method of preparing this kind of cinnabar.

*Method of preparing cinnabar exactly reſembling the cinnabar of antimony made with ſublimate.*

Take, of quickſilver, ſix pounds, of flowers of ſulphur, one pound: incorporate the quickſilver with the melted ſulphur; and, having pounded the maſs, ſo that the ſeveral parts of it may be well mixt together, put it in a coated body, of which it will fill almoſt half; and ſublime it, in the naked fire: taking away, after the ſublimation, ſuch parts as have not the proper ſtriated, or needlelike appearance.

*Note.*

*Note.*

The particular manner of conducting this proceſs, may be regulated by the directions more particularly given before, in the proceſs for preparing the cinnabar for vermilion.

The cinnabar, prepared from this proportion of quickſilver and ſulphur, is, in every reſpect, ſimilar to that made from the ſublimate and crude antimony, and may be ſubſtituted for it, without any real injury to the medicinal intention: for, notwithſtanding the manner of preparation, and the authority of long uſage, there is really nothing more in the cinnabar made from the ſublimate and antimony, ſuppoſing it intirely freed from the butter, or antimonial cauſtic, that ariſes along with it, than in that made from quickſilver and common mineral ſulphur: for the ſulphur of the antimony, which is the common mineral ſulphur, being ſeparated from the reguline part of the antimony, combines with the quickſilver in the ſame manner, as any other portion of ſuch ſulphur would; and ſuffers the ſpirit of ſalt, which the ſublimate contains, to raiſe with it the reguline part of the antimony; the quickſilver, which is the other conſtituent, being left at liberty to combine with the ſulphur. Nor is it of any real conſequence to add the crude antimony to the quickſilver, and ſulphur, uſed in the proceſs here given, even though the quantity of ſulphur be very ſmall; for

without the medium of the ſpirit of ſalt, which is added by uſing the ſublimate, to ſeparate the reguline part from the ſulphur, they remain combined; and paſſively ſuffer the cinnabar to be ſublimed, and leave them in their intire ſtate; without undergoing themſelves, or producing any change in the cinnabar.

The cinnabar of antimony is ſubject to the ſame adulterations as the fictitious cinnabar; and they may be diſcovered by the means before directed: but, if it be had unlevigated, and the ſtria appear like long needles, there can be no room for either ſuſpecting any adulteration, or ſubſtitution: unleſs of fictitious cinnabar, prepared in ſome manner parallel to that here given for the imitation of cinnabar of antimony; againſt which, there can be no guard, as they are, in fact, the ſame thing in every reſpect.

*Regulus and ſulphur auratum of antimony.*

Take, of antimony, ſixteen ounces, of tartar, one pound, and of nitre, half a pound; let them be ſeparately powdered, and mixed well together: then let this mixture be put, gradually, into a red-hot crucible, fuſed with a very ſtrong fire; and afterwards poured into a proper conic mould.

The

The metalline part, commonly called the regulus of antimony, will ſink below the ſcoria; and muſt be ſeparated from it.

The ſcoria muſt be diſſolved in water; and the ſolution filtered through paper: after which a precipitation muſt be made, from it, of the ſulphur; by dropping, into it, ſpirit of ſea ſalt: and, laſtly, the precipitated matter muſt be freed, from the ſalts, by waſhing in water.

*Note.*

This is according to the college of London; and, indeed, is the old proceſs given by Lemery; and, from him, by Quincy. The method is ſomething more expenſive than neceſſary; becauſe the tartar and nitre might be wholly omitted, if eight or ten ounces of pearl-aſhes, or any fixt alkaline ſalt, were ſubſtituted in the place of them, as they act no other way advantageouſly, with reſpect to the end of the proceſs, than by producing a fixt alkaline ſalt; and, in this caſe, the regulus would be more ductile; and, conſequently, more eaſily formed into cups, or any other figured veſſel, for making the antimonial wine.

But, as the conſumption of this kind of regulus is very ſmall, it is not of great conſequence which method is perſued.

But, if the ſulphur auratum ſhould be, however, demanded in any larger quantity, the uſe of the pearl-aſhes, inſtead of the nitre and tartar, would be found much more advantageous; and may be ſubſtituted in the following manner.

*Cheap and compendious method of producing copiouſly the ſulphur auratum antimonij.*

Take, of antimony, and any fixt alkaline ſalt, equal parts: powder the antimony; and, having mixt it thoroughly with the ſalt, put them into a crucible; and give them a fuſing heat: when they are thoroughly melted, pour the maſs into a deep mold greaſed; and, when cold, ſeparate the ſcoria from the reguline part; and boil it, for ſome time, in water, to diſſolve the ſalt: filter the ſolution through paper; and, afterwards, drop ſpirit of ſalt, very gradually, into it, ſo long as it appears to produce any turbidneſs, or effervescence; the ſulphur will be by this means precipitated, which muſt be waſhed in ſeveral ſucceſſive quantities of water; and then ſeparated, from the fluid, by means, firſt of decantation,

tion, when the ſediment is perfectly ſubſided; and afterwards of draining off the remaining moiſture through a filter, in which a linnen cloth is laid over paper: and, being of due conſiſtence, it muſt be, at laſt, dried on a board, in the ſhade.

*Note.*

This method will produce much greater quantities of the ſulphur, than where nitre is uſed: as a conſiderable part of what the antimony contains is deſtroyed in the deflagration; eſpecially, where tartar is not at all, or only ſparingly, uſed in the deflagration.

At preſent this improvement is of no great moment, to the practice of commercial chemiſtry, as the demand for it is ſmall: but when, as may probably happen ſome time, the ſecrets of a certain great empiric ſhall be revealed to the world, and it ſhall be found, that many of his moſt boaſted cures were owing to this remedy, it will doubtleſs be brought, for at leaſt ſome time, into high vogue; and the demand for it ſo increaſed, as may make it well worth while to inquire after the eaſieſt means of producing it.

The regulus, prepared in this manner, will be, perhaps, ſuperior to all others, as well for medicinal, as other purpoſes: but where regulus of antimony is wanted, for any other than medicinal uſes, it is uſually prepared with ſteel: and,

indeed, that kind will equally well anſwer every intention as a medicine: and is moſtly ſubſtituted for the other; from which, it has no eſſential difference; it being the ſame, in effect, whether the redundant ſulphur of the antimony be attracted, from the proper metallic part, by means of fixt alkaline ſalts, or iron.

The common method of preparing the martial regulus, (as it is called,) is as follows.

### *Martial regulus; or regulus of antimony prepared with ſteel.*

Take, of ſmall nails, two pounds and a half: put them into a large crucible, placed upon a tile, in a melting, or wind furnace; let the fire kindle about them gradually, till the nails are ready to melt: then project, by a large ſpoonful at a time, of antimony, one pound, of nitre, four ounces, and of tartar two ounces, all powdered, and mixed well together. Bury the crucible in charcoal; and, ſhutting the door of the furnace, let it ſtand in the ſtrongeſt fuſion, till the mixture it contains has done ſparkling: then take it from the fire; and pour the matter into an iron mortar, made hot, and previouſly greaſed. When the maſs

mass is cold, beat off the scoria from the regulus.

*Note.*

This is the regulus as commonly used for other than medicinal purposes; but for those, it is generally directed to be converted into the regulus stellatus; which is done, by repeated fusions with additional quantities of nitre.

But where iron is used, the addition of nitre and tartar is needless; the iron being sufficient to attract the redundant sulphur from the reguline part of the antimony: but the scoria formed by the sulphur and iron without salts, being of an hard untractable nature, it is difficult to separate it from the regulus; for which reason, it is proper to add a quantity, equal to half the weight of the iron, of the sal enixum, or caput mortuum, after the distillation of nitre; which, in most elaboratories, is otherwise generally thrown away: and this proportion of salt will render it very easy, by soaking in water, to scrape off all the scoria without any loss of the regulus.

The quantity of iron is, likewise, much more than requisite: as an equal weight will be fully sufficient to absorb the redundant sulphur: the college of Edinburg have directed only half the weight: but then they have greatly enlarged the proportion of nitre and tartar; the alkaline salt, formed from which, make up for the deficience of the iron. This, however,

can ſcarcely be called the martial regulus, or preparation of the regulus of antimony by ſteel; becauſe, if the iron were omitted, the operation would ſucceed equally well: as appears from their proceſs for the common regulus, in which, the proportion of the nitre and tartar are the ſame as for this, and no other circumſtances different, beſides the omiſſion of the iron.

The martial regulus may be, therefore, beſt prepared by the following method.

### *More profitable preparation of the regulus of antimony, by means of ſteel.*

Take, of crude antimony, and iron nails, each one pound, of the ſal enixum, or caput mortuum, after the diſtillation of ſpirit of nitre by Glauber's method, half a pound, of pearl-aſhes, or any fixt alkaline ſalt, two ounces: put the iron nails into a crucible, and place it in a wind furnace; and, when it is white hot, throw in the antimony and ſalts powdered together, by a large ſpoonful at a time; giving the mixture time to recover its heat betwixt each addition: when the whole is commixt, cloſe the door of the furnace, and continue the

the mixture in a fuſing heat, for ſome minutes; and then pour it out, into a deep copper mould, a little deviating from the cylindrical form, (that the maſs of metal may the more eaſily be turned out of it), heated, and greaſed; and, when it is cold, let the end of it, where the ſcoria adhere, be ſoaked, for ſome time, in water, which will make them crumble off, without a neceſſity of breaking the caſt of the regulus.

*Note.*

It is by methods ſimilar to this, that regulus of antimony is prepared for the uſe of the pewterers, by thoſe, who make it their particular buſineſs: and it is indifferent, by what means, the common ſulphur, contained in the crude antimony, is extracted from it: or whether iron, or the fixt alkaline ſalt, produced by the addition of nitre and tartar, be the inſtrument. But where nitre is added to the fuſed regulus without tartar; or with a great exceſs in quantity, as in the preparation of the ſtellate regulus, as it is called, an eſſential difference is wrought: for the nitre deſtroying, or the fixt alkaline ſalt, produced by it, abſorbing, more of the ſulphur of the regulus, an approximation is made towards that ſtate, in which antimony is moſt forcible in its operation

ration on the human conſtitution; as it is only, by a perfect calcination of the fixed ſulphur, the glaſs of antimony, the moſt powerful of all the preparations, is formed.

It was from this difference, therefore, that all the old proceſſes direct the continuation of thoſe parts of the operation, which they thought neceſſary for the producing what is now called the ſtellated antimony, without diſtinguiſhing it by any name from the leſs calcined martial regulus; but giving this the name of martial to diſtinguiſh it from what is made by means of nitre and tartar; which they called the common: and as, therefore, the regulus is undoubtedly of a more powerful operation, as a medicine, in this ſtate, it ought to be reduced to it; where the intention of the preſcriber is to have it ſo. But as that part of the common proceſſes, which reſpects the converting the martial regulus, produced as above, into the ſtellated kind, are unneceſſarily complex and laborious, I will, after giving them, as they are generally directed, ſhew the moſt ſimple and expedite method of preparing it.

### *Preparation of the ſtellated regulus of antimony, from the martial regulus.*

Take, of the martial regulus, freed from the ſcoria, one pound: put it, in a crucible, into

into a wind furnace; and, being in fuſion, add to it two ounces of nitre powdered: let it continue in the fire, till all appearance of the deflagration be over; and then caſt it into a mould, as before: let this operation be repeated, three or four times; the ſame quantity of nitre being uſed; and care being taken, that the regulus be in perfect fuſion, the laſt time the nitre is added: the ſcoria being then taken off, after the regulus is cold, the appearance of a ſtar will be found on the ſurface.

*N. B.* In order to have the ſtar ſhew itſelf more favourably, the regulus may be caſt, the laſt time, into the bottom of a mortar, previouſly greaſed, inſtead of the deep mould.

*Note.*

The Edinburg college order equal parts of nitre, and tartar, to be uſed; and a great proportion to be employed; but this can anſwer no end; for the greateſt part of the nitre, deflagrating with the ſulphur, in the tartar, has no action on the antimony; producing only a proportionable quantity of fixt alkaline ſalt, which is of no effect here: the end of this repeated fuſion, with nitre, being only to deſtroy

ſtroy a part of the ſulphur of the antimony; by which means the ſtellated appearance is produced.

The repeated operations of fuſion, and deflagration, are unneceſſary; for, with leſs nitre, and an addition of ſome fixt alkaline ſalt, to aſſiſt in abſorbing the remains of the refluent ſulphur, one fuſion may be made to ſerve the end equally well, by the following method.

*More compendious and expedite method of preparing the ſtellated regulus of antimony, from the martial regulus.*

Take, of the martial regulus, freed from the ſcoria, one pound: being put into a crucible, ſet it in a wind furnace; and, when thoroughly fuſed, throw into it, by a ſpoonful at a time, of nitre, two ounces, and of any fixt alkaline, three ounces; ſtirring the mixture well together, with the end of a tobacco-pipe, betwixt each addition of the nitre and alkaline ſalt, as well as when the whole is thrown in. Let the matter remain, for ſome time after, in ſtrong fuſion; and then caſt it into an iron mortar greaſed; and, when cold, take off the ſcoria.

*Note.*

By this means, the ſtellated regulus may be produced with greatly leſs trouble and expence: for the quantity of nitre uſed will be ſufficient to deſtroy the due proportion of the proper ſulphur of the regulus: and the alkaline ſalt will abſorb any remainder of the common ſulphur: and if the ſtellated appearance ſhould not be found, which will ſometimes be the caſe, in every method of preparation, it is not in the leaſt material, with reſpect to the medicinal efficacy of the regulus.

Though cuſtom has eſtabliſhed the uſe of nitre, in this further preparation of the regulus, after the firſt precipitation of it from the ſulphur in the crude antimony: yet, the fluxing it twice with fixt alkaline ſalts, mixed with a little crude tartar, is much the beſt way of further purifying the regulus; and it has this further good effect, where it is wanted for making the antimonial wine, that the texture is not rendered ſo unfit for that uſe; as it remains ductile; and may be eaſily caſt into any ſuch kind of form.

*Crocus antimonij, commonly called crocus metallorum.*

Take, of antimony, and nitre, an equal weight: being ſeparately powdered, let them be

be well mixed together; and put, by degrees, into a red hot crucible, where they may be fuſed: having poured them out of the crucible, let the ſcoria be taken off from them. The maſs will then appear of various colours; and the longer it has continued fuſed in the fire, the more it will approach to yellow.

*Note.*

This is the crocus antimonij of the college, and of the old practice: but the modern preparers of medicine have introduced another kind, more profitably prepared by the uſing a leſs proportion of nitre; by which, not only a ſaving is made, in the quantity of the deareſt ingredient; but leſs of the ſulphur of the antimony being deſtroyed, the produce is neceſſarily greater. The ſmall conſumption, made of this preparation in medicine, would not, perhaps, have afforded any temptation to this practice: but the crocus metallorum, being one of the capital articles of the farriers, who uſe every thing in great quantities, the demand for it has been conſiderable enough to induce the great dealers, to think of obtaining this, as well as other articles, at the cheapeſt rate they could.

When the crocus metallorum is prepared in great quantities, there is, likewiſe, a much leſs troubleſome and expenſive method of performing

ing the deflagration, than by the uſe of any furnace: which is by producing the neceſſary effect, with reſpect to the fuſion, by the heat generated by the matter itſelf, in conſequence of the exploſive action of the nitre, and ſulphur contained in the crude antimony; and this exploſive action may be rendered more efficacious, to this end, by the addition of a ſmall quantity of ſea ſalt to the other ingredients. The beſt method of conducting this operation, and the proportion of nitre generally made uſe of, are as follows.

*Method of preparing the common crocus metallorum, without uſing any furnace, or employing any exterior heat.*

Take, of crude antimony, ſixteen pounds, of nitre, fourteen pounds, of ſea ſalt one pound: powder the antimony and nitre ſeparately; and then mix them thoroughly together, adding the common ſalt: put this mixture into an iron pot, ſuch as is commonly uſed for boiling fleſh, of a proper ſize; and cover the pot with a flat plate of iron, or large ſtone; leaving, nevertheleſs, ſome vent for the vapour to tranſpire: ſet the pot in ſome open place in the air; and ſet fire to the mixture contained in it, by

means of an iron rod, or ſmall end of a tobacco pipe heated, and thruſt into it; and let it continue to burn, till the fire extinguiſhes of itſelf: when the eruption of the fumes is ſo abated, that it may be proper to approach the pot, ſtrike it ſeveral times on different ſides, that the concuſſion may make the melted metallic part ſeparate, by its weight, from the ſcoria: and then ſuffer it to ſtand till it be cold: the matter being taken out of the pot, the ſcoria muſt be ſeparated from the liver coloured maſs, which is the crocus metallorum.

*Note.*

This is the common crocus metallorum, which is uſually found in the ſhops: it may be diſtinguiſhed from that, made according to the regular proceſſes, with equal parts of nitre and antimony, by its being leſs yellow; and having a more equal and liver like appearance. It is eſteemed leſs powerful in its operation, as a medicine, on account of the ſulphurs not being diminiſhed in ſo great a proportion in it, as in the other; and probably with reaſon: but, as there is a certain limitation, with regard to this circumſtance, ſince the deſtroying too much of the ſulphur will weaken the medicinal operation, as well as the leaving too much

much undeſtroyed, it is not eaſy to determine, where the exact degree lies: though the fuſion of equal parts of the crude antimony, and nitre, is ſaid to be the proportion moſt likely to produce it.

### *Diaphoretic antimony.*

Let powdered antimony be thoroughly mixed with three times its weight of nitre; and, gradually, put into a crucible juſt beginning to glow: then, the mixture being taken from the fire, let it be purified by waſhing in water, as well from the ſalts, as from the groſſer parts leſs perfectly calcined.

### *Note.*

This preparation ought to be made with care: for, if the whole of the antimony be not reduced to calx, extremely active qualities will be found in it; and produce very unlooked for, and troubleſome, effects, in thoſe to whom it is given.

The moſt material object of care in the preparation, ſhould be the powdering finely, and mixing thoroughly, the ingredients: for, if that be done, and the matter be well ſtirred with the ſmall end of a tobacco-pipe, the calcination can hardly fail to be perfect; but, if, nevertheleſs, there appear any parts, that

will not ſoften on their maceration in boiling water, they ſhould be ſeparated; and, being well powdered, may be added to the next quantity of materials uſed for the ſame preparation.

The quickeſt method to free the calx, from the maſs of ſalts it is commixt with, is, after cleanſing the outward part of the crucible, to break it; and put the whole into boiling water, and continue it there, till all the calcined matter will eaſily ſeparate, from the crucible by a kniſe, or ſpatula, without ſcraping: and, when the ſediment has ſubſided perfectly, the parts of the broken crucible being previouſly taken out, the water ſhould be poured off; and freſh quantities added, two or three times: after which, to have the medicine in the greateſt perfection, the fine powder ſhould be ſeparated by waſhing over, according to the methods deſcribed p. 62.

This medicine ſhould never be taken from the hands of any, in whom an abſolute confidence cannot be placed: for, beſides the danger that attends the giving ſuch as is unduly prepared, it is liable to be adulterated by any cretaceous, or other ſimilar matter, without any means of detecting certainly the fraud. The moſt probable method of perceiving ſuch a ſophiſtication is, by pouring ſpirit of ſalt or nitre on the powder, which will produce an effervescence, if chalk, white lead, or many other ſubſtances likely to be uſed for this ſophiſtication, have been commixt with the calx of the antimony;

antimony: and, by this means, there is a great chance of discovering the adulteration, as the acid spirits have no effect on the calx itself: but there are other substances which may be used, that are intirely neutral with regard to all acids: and, therefore, though this experiment may be conclusive, in many cases, that there is an adulteration; yet it is not demonstrative, that none has been practised.

### *Bezoar mineral.*

Take, of the butter of antimony, three ounces: drop upon it, slowly, the same quantity of spirit of nitre: put the matter in a retort or small body, into a sand heat; and draw off the spirit: to the remaining dry matter, found in the bottom of the retort, or body, add two ounces more of the spirit of nitre; distilling off again, all that will rise, as before: repeat the same treatment three times; and then calcine the white powder, in a crucible, for an hour; using an intense heat: and edulcorate the calx by washing with water.

### *Note.*

The college of Edinburg, according to Lemery and Thebaut, use only as much spirit

of nitre, as will effervesce with the butter of antimony, and there is no more necessary.

They, also, direct the fire to be continued for only half an hour, and to be intense in the calcination; omitting, likewise, the edulcoration by washing; which is, indeed, rendered needless, if the fire be intense; as all saline parts will be intirely expelled by it.

As this is nothing but a calx of antimony produced by the destruction of the sulphur, by means of the nitrous spirit, the far greatest part of the process is of no consequence; and the repetition of the addition, and separation of so many successive quantities of spirit of nitre, is intirely needless. The following process has, therefore, been given as preferable to the common ones, on account of shortning the preparation, by leaving out the superfluous parts of it.

*More expeditious method of preparing the bezoar mineral.*

Take any quantity of butter of antimony; and drop it gradually into three times its weight of spirit of nitre: put it into a small glass body: fit on a head and draw off the spirit in a sand-heat: the remaining dry matter must, then, be put into a crucible; and calcined with a very strong fire.

*Note.*

*Note.*

This is a much quicker way of performing the proceſs; but the quantity of ſpirit of nitre is far too large, and, if we take the liberty of amending the proceſs in one point, by reaſoning on principles, we ſhould do it in all. If we, therefore, conſider the nature of the two ſubſtances, we ſhall ſee, that no more ſpirit of nitre can be of any conſequence, in the operation, than ſo much as will combine with the regulus contained in the butter of antimony: for, after the regulus and ſpirit are combined in a certain proportion, the compound becomes neutral to any further quantities of either of its two elements; and, whatever ſpirit of nitre, beyond the due proportion, is added, remains commixt with it, in a paſſive ſtate, till brought off in the diſtillation, without having produced any effect on the matter left behind. The true proportion, therefore, of the ſpirit of nitre, is ſo much as will produce any effervescence on being dropt upon the butter; which ſhould be carefully obſerved in the mixing them.

But there is yet another circumſtance of needleſs expence, in all the proceſſes for this preparation; which is the uſe of the butter of antimony, inſtead of the regulus; as will obviouſly appear, when we conſider, of what elements the butter of antimony conſiſts; and how the ſpirit of nitre acts on it to produce

the bezoar mineral. When the ſublimate and antimony are commixt together, and heated, in order to form the butter, the ſpirit of ſalt, one of the two conſtituents of the ſublimate, attracted more powerfully by the reguline part of the antimony, than by the mercury, the other conſtituent leaves it, and combines with the reguline part of the antimony; which is at the ſame time, by the ſuperior attraction of the mercury, ſeparated from the common ſulphur joined with it, in conſtituting the crude antimony; and the mercury, and common ſulphur, being thus freed from their former attractives, combine and form the cinnabar, as the ſpirit of ſalt and regulus form the butter of antimony; which being more volatile, or rather leſs fixed, than the cinnabar, riſes with leſs heat; and is, by that means, ſeparated from it. As the butter of antimony is, therefore, a compound of regulus of antimony and ſpirit of ſalt; the ſpirit of nitre being added, which is of ſuperior attraction, diſpoſſeſſes the ſpirit of ſalt of the regulus; and combines itſelf with it; and the ſpirit of ſalt, together with any redundant quantity of the ſpirit of nitre, is brought over in the diſtillation; leaving the regulus of antimony, and that due proportion of ſpirit, which, by its combination, it can fix. This being afterwards expoſed to the heat ſufficient for the deflagration of nitre: the ſpirit of nitre, combined with the regulus of antimony, deflagrates with it; and deſtroys the ſulphur, till the regulus be reduced to a calx; in the ſame manner,

manner, as if crude nitre had been uſed inſtead of the ſpirit.

It being evident, therefore, that, when the ſpirit of ſalt is diſtilled off in this proceſs, nothing remains but regulus of antimony and ſpirit of nitre; it reſults, that the regulus itſelf, as it would equally well combine with the ſpirit of nitre, would be effectually the ſame as the butter; and that the preparation might, therefore, be made much cheaper from the regulus, and ſpirit of nitre than by the more complex proceſs, where the butter is to be previouſly prepared. When, therefore, this medicament is demanded, it may be prepared in the genuine manner by this cheap and eaſy method.

### *A cheap and eaſy method of preparing genuinely the bezoar mineral.*

Take any quantity of the regulus of antimony prepared by any proceſs; and diſſolve it in ſpirit of nitre: evaporate the ſolution to dryneſs; and put the remaining matter, in a crucible, and calcine it, in a very ſtrong fire, for half an hour, or more, according to the quantity to be calcined.

### *Note.*

By this means, any quantity of the Bezoar mineral, exactly the ſame with that produced by the moſt elobarate proceſs, may be very ſoon

made. But as this is not known to thoſe, of whom it is demanded to prepare, or procure this medicine in the wholeſale concerns, they moſt frequently ſubſtitute the diaphoretic antimony for it; and if, indeed, they commit no greater fraud than this ſubſtitution, provided the diaphoretic antimony be carefully prepared, and well waſhed, they may be very well excuſed: for, undoubtedly, there is no difference betwixt the one and the other; as neither are any thing but the perfect calx of antimony; that is, the earth, which is the baſis of that ſemimetal, wholly deprived of the ſulphur by deflagration with nitre: in which operation, it is indifferent, whether the crude nitre, as in the diaphoretic antimony, or the ſpirit, as in the bezoar mineral, be employed.

### *Æthiops antimonialis.*

Flux equal quantities of antimony, and ſee ſalt, together, in a crucible, for an hour; then let the matter cool: break the crucible; and ſeparate the ſcoria: afterwards rub the regulus, thus obtained, with an equal quality of quickſilver, till they be incorporated.

*Note.*

This was a ſecret, by which, at one time, the greateſt wonders in medicine were pretended to be done. It has been, ſince, laid open to the

the public; and recommended, as a preparation of the higheſt importance: but, I believe, on examination, it will be found to have no further efficacy in it, than what belongs to the æthiops mineralis, prepared from common ſulphur. For it may be much doubted, notwithſtanding the antimony is here after the fluxing with ſalt, called by the name of regulus, whether any change be at all made in it by that operation; and, whether, conſequently, the crude antimony, uſed without any ſuch previous preparation, may not be equally well uſed for this purpoſe: indeed, if there is a great ground of preſumption, that the antimony really undergoes any alteration, by fluxing it thus, it muſt render the medicine very exceptionable; as in all approaches towards the reguline ſtate, the antimony acquires ſuch active powers, that ſcarcely any caution in the adminiſtering it, is ſufficient to countervail the hazard of its violent operation.

*Kermes mineral, or poudre des chartreux.*

Take, of antimony, four pounds, of ſolution of fixt nitre per deliquium, one pound, of rain water, three pounds: boil them two hours; and then filter the boiling decoction, through paper: let it then ſtand, at reſt, twenty four hours; and it will let fall a yellowiſh or ſaffron coloured powder, the fluid

fluid becoming clear. This fluid, being then poured off by inclination, the powder muſt be waſhed, by repeated affuſions of warm water; and, four ounces of ſpirit of wine being burnt upon it, afterwards dried, and kept for uſe.

*Note.*

The antimony ought to be extremely well powdered for this preparation; as the produce will greatly depend upon the fineneſs of it.

The uſe of fixt nitre, preferably to any other pure fixt alkaline ſalt, is without any reaſon: and ſoap lees will facilitate the extraction of the ſulphur from the antimony more than a meer ſolution of fixt alkaline ſalt.

The burning ſpirit of wine upon the ſulphur, thus extracted, is of no effect: for tho' it was ignorantly practiſed, as the means of edulcorating moſt of the antimonial and mercurial preparations, by the former chemiſts; yet, whoever conſiders, that it is only the vapour of ſpirit of wine that burns, and that the body of it, which is commixt with the kermes mineral, or any other matter, under operation, is only ſlightly heated, muſt be ſenſible of the abſurdity of it.

The ſame ſolution of alkaline ſalts, which was at firſt uſed, may, after the ſulphur has precipitated from it, on its growing cold, be equally well uſed again as any freſh quantity; for

for it is only through the diminution of the power of the menſtruum, by the abatement of the heat, that the precipitation is made: and it will, therefore, diſſolve, and take up, the ſame quantity again, when heated to the ſame degree; and may ſerve any repeated number of times, if water be added, to allow for the evaporation, and maintain the proper quantity of fluid.

The ſolution of ſalt ſhould, likewiſe, be poured back again, on the ſame quantity of antimony, and the boiling, and other ſubſequent treatment renewed; for it will be found to yield a conſiderable quantity of the ſulphur, notwithſtanding the firſt taken from it: and this may be with advantage even the third time.

The moſt profitable manner, therefore, of preparing the kermes mineral, will be found to be the following.

*Moſt profitable manner of preparing the kermes mineral.*

Take, of antimony, four pounds; and, having reduced it to a fine powder, put it into a ſolution of one pound of any fixt alkaline ſalt, diſſolved in three pints of water; or into three pints of ſoap lees; boil the mixture half an hour; and then filter the ſolution through paper, by means of two or three

three ſmall earthen cullenders; that it may not grow cold before it run through: let the filtered ſolution ſtand for twenty four hours; and, then, pour off the clear fluid, from the ſediment; and, putting it to the ſame powdered antimony it was before boiled with, repeat the former treatment; and do the ſame a third time, if the quantity of ſulphur, obtained the ſecond, give encouragement for it: the whole quantity of ſulphur, being, then, put together, the fluid muſt be drained off from it, in a filter; a linnen cloth being put over the paper: and the ſulphur muſt be afterwards dried, on a chalk-ſtone, in the ſhade.

The ſolution of fixt alkaline ſalt, or the ſoap lees, which ever were uſed, may be kept to be employed for the ſame purpoſe, another time; or a further precipitation may be made from it, of the ſulphur, by dropping ſpirit of ſalt into it, ſo long as any turbidneſs, or efferveſcence ſhall appear: but, if the repeating the boiling and precipitation be neglected, according to the firſt proceſs: more than half the kermes mineral,

neral, that may be produced, would be loſt.

*Note.*

By theſe means, the kermes mineral may be prepared very eaſily in any quantity : and, as it is, in fact, the ſame with the ſulphur auratum antimonij, they may be promiſcuouſly uſed ; or rather this method of making the ſulphur auratum may be ſubſtituted for the other ; as the antimony, after the extraction of the ſulphur, in this manner, will equally well, or even better, ſerve for the making the martial regulus, than while it is in its more crude ſtate.

*Fever powder.*

Take crude antimony and calcine it with animal oil for two hours ; then put it into nitre, melted in a crucible ; and let it continue there for ſome time ; and afterwards take out the matter, and waſh the ſalts from it, and dry it.

Take, alſo, quickſilver : diſtill it three times, from crude antimony : then diſſolve it in ſpirit of nitre ; and, having evaporated the fluid, calcine the dry maſs, in a crucible, till it turn yellow.

*Note.*

*Note.*

This is the proceſs for the famous fever powder, as given by the pretended inventor.

The calcination of the antimony, with animal oil, is not of the leaſt conſequence to the preparation; for, ſo long as the antimony is commixt with any inflammable ſubſtance, its own calcination will be prevented: and, indeed, whatever change might have been produced in it, by any more efficacious operation, it would have been intirely fruſtrated again by the deflagration with nitre; which in all caſes brings the antimony to a perfect calx, where nothing remains, but that pure ſimple earth, which is the baſis of this ſemimetal; and does not appear to have the leaſt operation on the human body, nor can ever ſuffer any change in its nature while pure.

The abſurdity of diſtilling the quickſilver from antimony is equally great: for no analyſis of the antimony can be made by means of the addition of quickſilver alone; and, therefore, nothing can be imparted to the quickſilver from it; nor any other effects produced, than what the diſtillation alone may cauſe.

If we take away theſe inefficacious parts of the proceſs, and examine the other operations, we ſhall ſee, that the antimony is converted into the ſtate, where it is called the diaphoretic; and by the ſame direct means; and the quickſilver, into the red precipitate, imperfectly calcined: which two preparations, conſequent-

ly, compoſe this boaſted remedy. In what proportion, theſe are commixt, to form the powder, has not been hitherto revealed by the preparer of it; nor, perhaps, abſolutely ſettled in his own practice; but, from the manner of operation, one may well preſume, that the mercurial part is ſmall, compared to the antimonial; as, otherwiſe, more frequent evacuations, or other ſenſible effects, would occur on its being taken.

*Preparation of the Greek water (for the ſolution of ſilver, for the converting red, or light coloured hair, into a deep brown.)*

Take any quantity of ſilver filings, and diſſolve them in ſpirit of nitre, proved or purified according to the directions given p. 174; the ſpirit of nitre, and the ſilver, being put in a mattraſs, muſt be placed, firſt, in a gentle ſand-heat, and afterwards removed where the fluid may be made to boil for a ſhort time: being taken out of the ſand-heat while yet hot, add as much water as may have evaporated during the boiling; and, when the ſolution is grown cold, decant off the clear fluid from the ſediment, if there be any, and the undiſſolved part of the ſilver filings; which may be diſſolved, likewiſe,

likewiſe, by adding more ſpirit of nitre, and repeating the ſame treatment.

*Note.*

The ſolution of ſilver, thus obtained, is the Greek water, uſed for turning red, or light coloured hair to brown. Its efficacy may be greatly improved by waſhing the hair, before the application of the water, with common water, in which ſome ſalt of tartar, or any other fixt ſalt has been diſſolved; the proportion may be an ounce and half of the ſalt of tartar, to a pint of the water.

*Lunar cauſtic.*

Diſſolve pure ſilver, in about twice its weight of aqua fortis, in a ſand-heat: then, the heat being increaſed, evaporate to dryneſs: afterwards melt the matter, in a crucible, that it may be poured into proper molds; carefully avoiding too great heat, leſt it grow thick, beyond the juſt degree.

*Note.*

The college of London, in this proceſs, have done very improperly, in directing aqua fortis inſtead of ſpirit of nitre: for the aqua fortis, containing a proportion of oil of vitriol, will

fail to make a perfect ſolution of the ſilver; of which a part, therefore, will be corroded only.

The college of Edinburg have avoided this miſtake; but have fallen into a greater, in ordering the fuſion to be continued, ſo long as the matter ſhall emit any fumes: by which circumſtance, they deſtroy, in a great degree, the efficacy of this medicament: for its only uſe, being, as a cauſtic, and its eſcarotic quality, depending on the concentrated acid of the ſpirit of nitre, if that acid be thus expelled, a proportionable diminution of its ſtrength muſt, conſequently, accrue. The manner of preparing the lunar cauſtic, ſhould be, therefore, as follows.

*Beſt method of preparing the lunar cauſtic.*

Take, of ſilver filings, any quantity: put them, in a ſmall glaſs body, with three times their weight of ſpirit of nitre, purified according to the directions given p. 174: let the body remain without heat, till the ſpirit of nitre appear no longer to act on the ſilver; and then place it in a moderate heat, till all the ſilver be diſſolved: after which, firſt evaporate away the moiſture, and then put the dry maſs into a crucible; and give it a heat juſt ſufficient, to make it run into

fuſion: as ſoon as it is melted, pour the matter into proper formed iron molds, ſlightly greaſed.

### *Salt of ſteel.*

Take, of ſtrong ſpirit, or oil of vitriol, ten ounces, of ſteel filings, four ounces, of water, two pints: mix them; and, the effervescence being over, let the mixture ſtand, for ſome time, in hot ſand: then pour off the fluid; and filter it through paper; and, after the neceſſary evaporation, ſet it to chryſtallize.

### *Note.*

This proceſs of the college is at preſent ſeldom obſerved: for, as this is only an artificial preparation of green vitriol, exactly the ſame with the natural, the latter is ſubſtituted in the place of it; but ſhould be firſt purified, and treated in the following manner.

### *Method of converting the common green vitriol into ſalt of ſteel, equally good with that prepared by the regular proceſs.*

Take, of common green vitriol, any quantity: diſſolve it in four times its weight of

of boiling water; filter the ſolution, thro' paper; and add, to it, oil of vitriol, in the proportion of two drams to every ounce: let it then ſtand to chryſtallize; and, when the chryſtals are formed, take them out, and dry them, in the ſhade.

*Note.*

This will equal, in all reſpects, the ſalt of ſteel prepared by any other proceſs: as the additional oil of vitriol will prevent its growing turbid, and brown, by keeping; and it may, therefore, be allowably ſubſtituted for the kind regularly prepared.

*Ens veneris, or flowers of ſteel.*

Take, of waſhed colcothar of green vitriol, or of ſteel filings, one pound, of ſal ammoniacum, two pounds: mix, and ſublime them, in a retort; and re-commix what remains in the bottom of the retort with the flowers, by pounding them together: repeat the ſublimation, till the flowers acquire a beautiful yellow colour: to what remains after the laſt ſublimation, half a pound of ſal ammoniacum may be added; and the

mixture ſublimed as the other; and this method may be repeated, as long as the flowers can be obtained of a good colour.

*Note.*

A difficulty ſeems to be ſuppoſed, in this proceſs of the college of London, of obtaining good coloured flowers at the firſt ſublimatien: but it is very eaſy to do it, if proper methods be perſued; and with a much leſs quantity of ſteel, or colcothar, than is here preſcribed; tho' the cheapneſs of thoſe ingredients renders it, indeed, a matter of indifference, what quantity is uſed. But the college have been extremely careful to make up for the redundance, at firſt uſed, by directing, that ſubſequent ſublimations to produce half a pound, or leſs, of the flowers, each time, ſhould be made; that none of the colcother, or filings, may be waſted; not conſidering, that every ſuch operation would coſt, beſides the trouble, twenty times as much, as the value of the filings, or colcothar, ſaved.

The college of Edinburg make the ens veneris, and flowers of ſteel, to be different preparations; and direct the colcothar of blue vitriol to be uſed for the firſt: but where yelyel flowers can be prepared from the blue vitriol, (for it cannot be done with all parcels of it,) it muſt undoubtedly be from the iron contained in it; and they are, therefore, the ſame as thoſe prepared from green vitriol, or crude

crude iron: for which reaſon, wherever ens veneris is ordered, the flowers of ſteel, prepared as above, is the kind ſupplied: and they may be obtained perfect, with greater certainty, by one ſublimation, if the following method be uſed, than the college ſeem to think practicable, by their adviſing repeated ſublimations for raiſing a proper colour.

*Improved method of making the ens veneris, or flowers of ſteel.*

Take, of green vitriol, one pound: diſſolve it in two quarts of warm water; and precipitate the other from it, by adding to this ſolution, half a pound of pearl-aſhes, diſſolved in water: pour off the fluid, when the ſediment has ſubſided; and add freſh quantities of water, once or twice, to waſh the ſalts from the precipitated powder; which muſt afterwards have the remaining fluid drained from it in a filter; and then be dried.

Let ſix pounds of ſal ammoniacum be then powdered; the foul parts being ſcraped off, or picked out; and afterwards well mixed with the oker, or precipitated iron, prepared as above: put them into a retort,

with a very wide ſhort neck; and add, to them, two ounces of ſpirit of ſalt: fit on a very large receiver; and ſublime the flowers; gradually ſuppreſſing the fire, when nearly the whole is raiſed. If the neck appear to be choaked by the flowers, as muſt be concluded from the receiver's ſeeming unduly cold, the receiver muſt be taken off; and a paſſage procured, by opening a way, thro' the flowers in the neck, by a ſtick.

*Note.*

The precipitated oker of the vitriol may be prepared in a larger quantity; and kept ready for this uſe; and, if that be done, flowers of ſteel may, by this method, be prepared, with great certainty; and very little trouble, of the moſt full and bright yellow colour; if the fire be not too long continued: and what remains in the retort, or is found diſcoloured in the neck, may be uſed for making the volatile ſpirit of ſal ammoniacum; for which purpoſe, it will be no way damaged by the treatment of it in this proceſs: or this caput mortuum, and other foul parts, may be expoſed to the air to deliquate, as the London college adviſe, in order to make the deliquated ſteel, which is the fluid that will run from it.

It is not an eaſy matter to adulterate the flowers of ſteel without deſtroying the bright colour;

colour: for there is no ſubſtance of the ſame teint, that would not be equally dear: and if ceruſs calcined yellow, or yellow oker, be uſed, they will greatly diminiſh the vividneſs of the colour; ſo that, if any ſo ſophiſticated be compared with a ſpecimen of ſuch as is perfectly good, the difference will be eaſily perceived. But a more certain proof of any ſuch adulteration may be quickly made, by putting the flowers into a crucible, and giving a ſubliming heat; which will diſſipate them, leaving the ceruſs, oker, or any ſuch matter, alone in the crucible.

### *Aurum moſaicum.*

Take, of tin, one pound, of flowers of ſulphur, ſeven ounces, of ſal ammoniacum, and of purified quickſilver, each half a pound: melt the tin; and add the quickſilver to it: when the mixture is become cold, powder it; and mix it, intimately, with the ſal ammoniacum, and ſulphur: then ſublime them in a mattraſs: the aurum moſaicum will be found under the ſublimed maſs, with ſome droſs, at the bottom of the mattraſs.

### *Note.*

The proportion of quickſilver, and ſal ammoniacum alſo, are in this proceſs of the college,

leſs, by one half, than in thoſe of the Edinburg pharmacopeia, and other books: but, being ſufficient to anſwer the end, this diminution is a real improvement of the preparation; as conſiderably leſſening the expence.

The conduct of this proceſs is ſomewhat critical; for it very often miſcarries; at leaſt, with reſpect to the quantity of the perfect produce: as, frequently, only a ſmall part of the cake is found of the due colour and brightneſs.

In order, therefore, to avoid the cauſes of this failure, it is beſt to ſcrape off, and pick out all foul parts of the ſal ammoniacum; and to take care, that the tin, and quickſilver, particularly the latter, be not adulterated with lead.

The calcination is beſt performed in a coated glaſs body, in the naked fire: for there is no certainty, in a ſand heat, of raiſing the cinnabar formed by the quickſilver, intirely from the tin, without a longer continuance of the heat, than is conſiſtent with the ſucceſs of the operation, in the main point. The coated body ſhould be of a very long form; and little more of it ſhould be expoſed to the heat, in the cavity of the furnace, than the part containing the materials. By having a great part of the body out of the heat, the whole of the ſal ammoniacum, and quickſilver, may be preſerved; as the ſal ammoniacum will be collected with part of the ſulphur near the top of it, and the quickſilver with the other part of the ſulphur, combined in the form of cinnabar, nearer to where it is expoſed to the fire:

the ſal ammoniacum, thus ſaved, may be uſed for making the volatile ſpirit; for which purpoſe, the ſulphur commixt with it will no way injure it: and the quickſilver converted into cinnabar may be, with any other quantities of foul cinnabar, or calomel, revived by diſtillation with quick-lime and pearl-aſhes; and, by this means, the principal expence in making the aurum moſaicum re-imburſed.

### *Flowers of biſmuth.*

Take any quantity of biſmuth, or tin glaſs: reduce it to a fine powder; and mix it thoroughly with double its weight of nitre powdered alſo: put the mixture, by half a ſpoonful at a time, into an earthen body perforated in the ſide and furniſhed with allodials, when the body is red-hot: the operation being over, take off the allodials; and collect the flowers; which will be found in them, by ſweeping them out with a feather.

### *Note.*

This is the beſt proceſs, which has been hitherto given, for the flowers of biſmuth; and is much preferable to Lemery's method of uſing a previous calcination, like that of lead, and

and ſubliming the flowers with ſal ammoniacum inſtead of nitre. This may be yet, however, rendered more ſafe, and eaſy; if the earthen veſſel, inſtead of the form of a body or cucurbit, be made in that of a retort, and tubulated in the bend of the neck, directly over the center of the bottom. The tube ſhould be about an inch and a half high, and of about an inch diameter; and through the orifice which this tube affords, the matter may be much better thrown in, out of a proper ſpoon, than through the hole in the ſide, as directed in the above proceſs; that cannot be cloſed by any convenient means; but will ſuffer the fumes of the biſmuth to break out: which muſt be avoided, both on account of the loſs of the flowers, and the nuſance it gives to the operator. The tube, in the earthen retort, ſhould have an earthen ſtopper made along with it; which ſhould be put into the hole, as ſoon as poſſible, after the matter is thrown in. The neck of the earthen retort ſhould be three inches wide in the narroweſt part: inſtead of the allodials, a large receiver ſhould be uſed; which will anſwer the end better, and with much leſs trouble: in this receiver ſhould be made a ſmall hole, for a vent to the air generated in the exploſion of the nitre with the ſulphur of the biſmuth; for otherwiſe the receiver will be very liable to be thrown off from the neck: nor ſhould the juncture of the receiver with the retort be made too cloſe or firm with lute for the ſame reaſon.

It is proper to put about an inch height of ſand, in the earthen body, or retort; in order to prevent the matter falling on the heated bottom of the veſſel, and cauſing it to crack: which will be generally the conſequence, if this precaution be not uſed.

The flowers of biſmuth have, at preſent, no place in medicine; but they are greatly uſed as a dry coſmetic, or rather fucus; giving a fairneſs, and clear appearance, to the ſkin, when rubbed on it. It is the general practice of the ladies, in Spain, and Portugal, to employ this ſubſtance, as a dry paint on their faces and neck; and a perſon in London, who prepared it to be ſent there is ſuppoſed to have got ſome thouſand pounds by the concern: it is now, alſo, coming into frequent uſe here, in the ſame way; and will probably be much more generally introduced than at preſent. As, therefore, the preparation called the magiſtery of biſmuth will anſwer the ſame purpoſe; and may be prepared with much leſs trouble, I will ſubjoin the beſt manner of preparing that alſo.

### *Magiſtery of biſmuth.*

Take four pounds of pure ſpirit of nitre; put it into a mattraſs; and add, to it, as much biſmuth powdered, as the ſpirit will diſſolve; which will be, according to its ſtrength,

ſtrength, about eight or ten ounces; precipitate, then, the biſmuth from the ſolution, by putting to it, gradually, four pounds of pearl-aſhes, diſſolved in three quarts of water, and filtered through paper: when the precipitated powder has ſubſided, pour off the clear water; and add ſeveral ſucceſſive quantities of freſh, to waſh away all the ſalts: the powder muſt then be freed from the remainder of the fluid, by draining through a filter of paper, with a linnen cloth laid over it: and afterwards dried on a chalk-ſtone in the ſhade.

*Note.*

This precipitation has been ordered to be made with ſea ſalt, inſtead of fixt alkaline ſalt: but that is by no means a proper, (though cheaper) method, where the magiſtery is intended to be uſed as a coſmetic: for, in that caſe, the acid, remaining conjoined with the biſmuth, would render it much too acrid for the ſkin: nor can it then be ſtrictly deemed a magiſtery; which ſuppoſes the precipitation to be made by ſeparating the acid diſſolvent. But when it is prepared as above, if the ſalts be intirely waſhed out, it is as gentle as the flowers made by the above proceſs; and may be ſubſtituted for them, for this purpoſe of a fu-

cus,

cus, though it is not abſolutely the ſame thing: this being in fact the biſmuth itſelf, unchanged any other way, than by reducing it to the moſt impalpable powder; and the flowers of the biſmuth reduced to a calx, containing only that earth, which is the baſis of this ſemimetal; the ſulphur being deſtroyed by the deflagration with the nitre.

The flowers, or magiſtery of biſmuth, are very liable to be adulterated by chalk, lime, or white lead: all which render it injurious, when uſed conſtantly as a dry fucus: and it is very difficult to furniſh a ſimple method of detecting the abuſe. If, however, the flowers appear lighter than a proper ſpecimen, they may be, with certainty, concluded to be adulterated with chalk, or ſome calcarious earth: and if it be ſuſpected, they are ſophiſticated even where of due weight, the putting ſome of the flowers into a crucible, with the ſame bulk of charcoal duſt thoroughly mixt with them, will ſhew, if white lead, or calcined tin, be commixed with them, by reducing thoſe metals to their metallic ſtate; in which they will be found in the bottom of the crucible. But this trial will not avail in the caſe of the magiſtery; for the biſmuth, not having been analyzed in the preparation, will itſelf be fuſed; and combine with the lead, or tin, in one equal metallic body.

*Diſtilled*

*Diſtilled verdigriſe ; properly, chryſtals of verdigriſe.*

Take, of the beſt verdigriſe, four ounces, and of diſtilled vinegar, one quart : the verdigriſe being well powdered, put them together into a mattraſs, with a ſmaller one inverted into the neck of it ; and place it into a gentle ſand-heat ; where it muſt remain, being ſometimes ſhaken, till the vinegar has diſſolved as much as it can of the verdigriſe. Put it, then, into a proper glaſs for the decanting the clear fluid from the ſediment ; and, when it has ſtood a due time to ſettle, let the fluid part be carefully poured off ; and evaporated to about one third. It muſt then be ſet to ſhoot in a receiver with a wide neck ; and, when the chryſtals are formed, they muſt be taken out, and carefully dried.

A freſh proportion of vinegar may be added to the part of the verdigriſe, which the firſt quantity left undiſſolved ; and the mothers, or fluid, remaining after the chryſtals were formed, may be put to it ; and the other

other parts of the proceſs repeated as before: by which means, a ſecond quantity of chryſtals will be obtained.

*Note.*

The verdigriſe, uſed for this purpoſe, ſhould be choſen by its green colour, and tranſparency: for, where it happens to be dried to a greyiſh blue powder, it will require a greater proportion of vinegar to form it into chryſtals.

The diſtilled vinegar produces the moſt beautiful chryſtals: but common vinegar is more frequently uſed by thoſe, who prepare them; as it is much cheaper, and will afford very good coloured chryſtals, if care be taken, in the evaporation, not to ſuffer any part of it to burn to the glaſs.

This preparation is ſeldom uſed in medicine: but is of great value in ſome kinds of painting; as it will, when worked in varniſh, retain its beautiful green colour; which far ſurpaſſes that of any other pigment: the great demand there is at preſent for this ſubſtance, on account of its being uſed for painting coaches according to the new taſte, makes it well worth the notice of thoſe, who are concerned in other chemical articles, to endeavour to prepare this in perfection.

*Fictitious*

*Fictitious Roman vitriol.*

Take twelve pints of water; and drop, gradually, into it, five pounds of oil of vitriol, to which has been added half a pound of ſpirit of nitre: put the whole into a large glaſs receiver; and add, to it, ſix pounds of copper, or braſs, in filings, or thin plates: let it remain cold till the more violent effervescence, which will at firſt appear, be abated, and, then, place it on a ſand-heat, which may be increaſed, occaſionally, till the acid ſpirit appear to be ſaturated with the copper: let the fluid, then, ſtand at reſt, till it become clear: when pour it carefully off from the feces; and add ſome water to them, to bring off the remaining part of the ſolution, or to diſſolve any chryſtals of the vitriol that may be ſhot: decanting off this waſhing in a leſs veſſel, and of a more proper form than the receiver. Add this to the firſt fluid, and evaporate away half the quantity in a leaden boiler; and then ſet the remainder in a large receiver to ſhoot into chryſtals, the chryſtals being formed

formed and taken out, keep the mothers, or remaining fluid, to be added to a freſh quantity of the ſolution, in order to its affording the ſalt yet diſſolved in it; or, if the whole be done for experiment, or on ſome particular occaſion, the evaporation and cryſtallization may be repeated, till the whole quantity of the ſalt be obtained in chryſtals.

The fluid being drained from the chryſtals, when they are taken out, in an earthen cullender, the ſalt ſhould be laid to dry in the ſhade; taking care, that no heat approach it; which, otherwiſe, would calcine the chryſtals, and hurt their tranſparency and beauty.

*Note.*

The Roman, or blue vitriol, is in many places found naturally produced: but not ſo copiouſly as to take away the neceſſity of preparing it by art; eſpecially, where refuſe copper, ſuch as the filings and ſweeping of ſhops, can be had in ſufficient quantity, and the oil of vitriol can be obtained at the preſent low price: this manufacture, indeed, ſhould be, as it is at preſent in one inſtance, joined to that of the oil of vitriol itſelf; as the unrectified ſpirit

from the ſulphur may be employed in it; which makes a ſaving in the whole proceſs.

The foreign Roman vitriol is not, in general, purely the ſalt of copper, but ſophiſticated either by nature, or art, with another body: but I ſhall avoid being more explicit on that point; leſt it give the hint to thoſe, who prepare it here, to avail themſelves of the knowledge of it, inſtead of continuing to make it pure, from the want of commodious means to do otherwiſe.

Excepting by this method, there is no danger of impoſition in the Roman vitriol; provided care be taken only to accept of none, but what ſhall be in chryſtals of a large, or moderate ſize, and of a full deep bright blue colour.

## SECTION V.

### *Of diſtilled waters and ſpirits, either not generally known, or to be made by cheaper or more compendious methods than are directed in the regular preſcriptions for them.*

*Simple cinnamon water.*

Take of cinnamon one pound, water ſufficient to prevent an empyreuma, (or burnt flavour): diſtill off one gallon.

*Note.*

This water is moſt frequently made by coction; the diſtillation, inſtead of improving it, making ſuch a ſeparation of the ethereal oil from the more ſoluble ſubſtances contained in the cinnamon, as renders it more incapable of remaining united with the water, without the aid of ſome other medium.

The ſimple cinnamon water, therefore, notwithſtanding diſtillation is ordered in the proceſſes both of the London and Edinburg colleges, is much better made in the following manner.

*Simple cinnamon water by coction.*

Take half a pound of cinnamon powdered groſsly, and one gallon of water: put them into a very large kettle, or a ſtill, and keep the fluid only of a ſimmering heat; that as little vapour may riſe as poſſible; when it has thus boiled, in the gentleſt manner, a quarter of an hour, return what may be come over into the ſtill; and, being cold, ſtrain off the water through flannel; and, after ſtanding, decant off the clear part, if any ſediment be found.

It may be prepared in leſs quantity in a mattraſs, with a long neck; having a ſmaller mattraſs inverted to make a circulation; and the operation may be performed in a ſand-heat.

*Note.*

By this treatment a ſtronger water may be obtained by coction from half a pound of cinnamon, than can be had from a pound by diſtillation: for, though a pound will undoubtedly afford double the quantity of oil, yet from want of ſome ſaline, or other ſaponaceous medium, to cauſe a combination of the oil and water, the oil neceſſarily ſeparates from the water, after the diſtillation; and leaves it much leſs ſtrongly impregnated, than where a leſs quantity is uſed, and the oil is not deprived of the ſaccharine juice, or other bodies of a ſaline, or ſapid nature, which aſſiſt its union with the water, when only a gentle coction is uſed, to extract it from the ligneous part of the bark.

The caſſia lignea is ſometimes uſed for making ſimple cinnamon water, on account of its much lower price than cinnamon: but, if, the water be not made very weak, diſtillation muſt be uſed: becauſe the caſſia imparts a ſtrong colour to the water; which would diſtinguiſh it from the genuine.

In all other reſpects the caſſia is equally good, for the purpoſes of making cinnamon water,

water, with the cinnamon itſelf; as the oils extracted from both are intirely alike: I am, indeed, ſatisfied, upon very good authority, that they are the bark of the ſame tree; and the only difference lies in the choice and preparation of it, with reſpect to the age of the parts it is taken from, and the manner of curing it.

*Spirituous cinnamon water.*

Take, of cinnamon, one pound, of proof ſpirit, one gallon, of water ſufficient to prevent an empyreuma: one gallon may be diſtilled off.

*Note.*

As the expence of cinnamon, in the proportion of one pound to a gallon, renders the preparation of this water very dear, a much cheaper method has been found of preparing it equally good, by ſubſtituting the caſſia in the place of the cinnamon; and leſſening, likewiſe, the quantity; the common cinnamon water is, therefore, prepared thus.

*Method of making cinnamon water at a ſmall expence, and equal to the beſt.*

Take, of the beſt caſſia lignea bruiſed, one pound, of melaſſes ſpirit, two gallons, of wa-

ter ſufficient to prevent the burning of the materials: diſtill off two gallons: to which, when intended to be uſed as a cordial, add one pound of ſugar, ſuch as is ſold at about eight pence per pound.

*Note.*

This quantity is only half the proportion of cinnamon, ordered in the college preſcription above given; but, if the caſſia be good, it will yield as high a flavour as is agreeable to the palate; a greater quantity of the oil producing a bitterneſs, and too great heat.

The uſe of melaſſes ſpirit will render this water much more ſoft and pleaſant than it can be made from the common proof ſpirit: which is apt to be foul, and hotter to the mouth. But where the point is to make the expence as ſmall as poſſible, common proof ſpirit may be uſed.

*Simple ſpirit of lavender, commonly lavender water.*

Take, of freſh lavender flowers, a pound and half, of proof ſpirit one gallon: diſtil, in balneo, till five pints be obtained.

*Note.*

As ſuch a quantity of the lavender flowers would make this water expenſive, it is very frequent

quent to join roſemary tops to them, and to make a much leſs quantity ſerve.

But there is another method of preparing this ſpirit more practiſed, than any of thoſe where immediate diſtillation is uſed; which is the commixing the foreign oil of lavender with ſpirit of wine without diſtillation; and adding, likewiſe, a quantity of the ſpirit of roſemary, to ſave the uſing even too much of the oil of lavender, though the foreign oil can be purchaſed much cheaper than it can poſſibly be prepared here. The moſt artful mixture of this kind is as follows.

*Extemporaneous and cheaper ſpirit of lavender.*

Take, of the foreign oil of lavender, one ounce, of the oil of roſemary, in which one drop of oil of cinnamon has been put, half an ounce: mix them with a gallon of clean proof ſpirit.

*Note.*

This will appear very agreeable and ſtrong; for the oil of roſemary, with a very ſlight ſcent of that of the cinnamon, reſembles greatly the lavender.

As this ſpirit, or water, as it is called, is principally prepared to be uſed as a ſcent, or perfume, theſe ſubſtitutions, or ſophiſtications, are of a very excuſable nature; and, indeed, with reſpect to medicinal purpoſes, there is ſo

great an affinity, in the qualities, betwixt the lavender, and the ſubſtances uſed for adulterating, or counterfeiting it, that, if the proportion of oil be any way joined to the ſpirit, it cannot be ſhewn, that the medicine is depraved with reſpect to the intention: nor is it material, whether ſpirits of this kind are immediately diſtilled from the vegetable materials, or prepared from the oils already diſtilled; provided the union be perfect, betwixt the ſpirit of wine and the eſſential oil; and that the ſpirit of wine be previouſly rectified to a proper degree of purity.

### *Compound ſpirit of lavender.*

Take, of ſimple ſpirit of lavender, three pints, of ſpirit of roſemary, one pint, of cinnamon, and nutmegs, each half an ounce, of red ſanders, three drams: digeſt, and filter.

### *Note.*

The deſign of the ſanders, being only to colour the ſpirit, which has been uſually made of a purpliſh red colour, the putting them to the ingredients before diſtillation, cannot poſſibly anſwer the end, in any degree; as no colour will riſe from them in the diſtillation: they ſhould, therefore, be infuſed in a part of the ſpirit, in a ſlight digeſting heat, or without heat, if a conſiderable time be given to them;

and then, the ſpirit being ſtrained off from them, ſhould be added to the whole quantity.

The compound ſpirit of lavender is, like the ſimple, frequently made by an extemporaneous preparation from the oils: and is not, when ſo managed, to be diſtinguiſhed from that, immediately diſtilled from the vegetables, or from the ſpirit diſtilled from the oils, by adding ſpirit of wine to them.

The following method of making this compound ſpirit extemporaneouſly is the beſt, I have hitherto met with.

*Extemporaneous and cheaper method of preparing the compound ſpirit of lavender.*

Take, of red ſanders, four ounces, of caſſia lignea, two ounces, of Jamaica pepper, one ounce: having broken the caſſia, and pepper, to a groſs powder, put them together into a mattraſs with the ſanders, with two quarts of ſpirit of wine; and ſet them to digeſt, in a ſand heat, ſometimes ſhaking the mattraſs; or, if they can be allowed to ſtand for a conſiderable time, this tincture may be beſt made without heat. After the due digeſtion, or infuſion, let the ſpirit be ſtrained off through flannel, to be added to a gallon of proof ſpirit; into which

which, muſt be previouſly put, half an ounce of ſpirit of lavender, and an ounce of ſpirit of roſemary: the whole quantity of ſpirit will then be of a clear red colour; but in order to give it that purpliſh full colour, which is eſteemed beſt, a ſmall quantity of the ſolution of any fixt alkaline ſalt muſt be added, by a few drops at a time, with ſuch intervals, as may admit of the effect of each addition's being perceived on the colour of the ſpirit before another be made: and by this means the ſpirit may be brought to have any degree of colour deſired.

*Note.*

The extemporaneous compound ſpirit of lavender may be prepared, likewiſe, with the ſame proportion of oils, as is correſpondent with the proceſs of the college above given: but this proportion is much more frequently uſed; as the oil of roſemary is much cheaper than the oil of lavender; and, with the addition of the ſpices, this variation in the quantities cannot be eaſily perceived; nor in fact, with reſpect to the medicinal intention, can it be proved to make any material difference.

As the preparation of this medicine, from the eſſential oils, inſtead of the vegetables themſelves immediately, does not, as we obſerved before,

before, render it any way different from the regular proceſs, this deviation may be tolerated: and, if there be any objection to it, the preparers are ſafe from the imputation of having done wrong, if they keep their own ſecret; for there is no poſſibility of diſtinguiſhing them.

### *Hungary water.*

Take, of the freſh tops of roſemary, one pound and a half, of proof ſpirit, one gallon: diſtill, in balneo, till five pints are obtained.

### *Note.*

The cheapneſs of the oil of roſemary, brought from abroad, has occaſioned the Hungary water to be prepared in general, like the ſpirit of lavender, from the eſſential oil.

As this ſpirit is moſtly deſigned for external purpoſes, where the ſcent is the principal quality regarded, it has been uſual to add ſome proportion of the oil of lavender to it; there being a much leſs grateful ſmell in the roſemary alone, than when combined with the other: but a leſs proportion of the lavender will anſwer the purpoſe, if a very ſlight ſcent of cinnamon be added to the roſemary; which gives it, that aromatic ſweetneſs, in which, principally, the lavender differs from it.

The Hungary water may be, therefore, eaſily prepared thus.

*Gheap*

*Cheap and extemporaneous method of preparing the Hungary water.*

Take, of the oil of roſemary, in which one drop of oil of cinnamon has been put, one ounce and half, of the oil of lavender, two drams: mix them with ten pints of proof ſpirit of wine.

*Note.*

As it is very neceſſary, in this, and all the above caſes, where no diſtillation is made after the oils are added to the ſpirit, to have it very pure, (which is not to be expected from the common proof ſpirit,) the kind called the rectified proof ſpirit, muſt be, therefore, from the diſtillers: but where that cannot be procured, the eaſieſt method is to lower the rectified ſpirit of wine to the proof ſtandard; and to uſe it inſtead of the other.

*Aqua mirabilis.*

Take, of cinnamon, two ounces, of rind of lemon peels, one ounce, of angelica ſeeds, leſſer cardamoms, and mace, each half an ounce, of cubebs, two drams, of leaves of balm, ſix ounces: on theſe ingredients bruiſed, pour a gallon of French brandy; and,

and, having infuſed them four days, diſtil off one gallon.

*Note.*

As the cubebs, galangals, and angelica ſeeds, do not yield an eſſential oil by diſtillation, they may be deemed unneceſſary ingredients for the making this water: and the place of the angelica ſeeds may be ſupplied by a ſmall proportion of the leaves.

The caſſia may, likewiſe, be ſubſtituted here, as well in the cinnamon water, in the place of the cinnamon, and the quantity increaſed; as may, likewiſe, that of the lemon peel; for the water will not be rich with the proportion of ingredients here given. This water may be, therefore, more cheaply and efficaciouſly prepared in the following manner.

*Method of preparing a more efficacious aqua mirabilis, with leſs expence.*

Take, of caſſia lignea, three ounces, of the rind of lemon peel, two ounces, of the leſſer cardamoms, and mace, each half an ounce, of dried leaves of balm, ſix ounces, and of the dried leaves of angelica, one ounce: pour upon them one gallon of proof ſpirit; and, having infuſed four days, add a ſufficient

cient quantity of water, to prevent an empyreuma; and diſtil off one gallon.

*Note.*

The mace and cardamoms might be omitted without impairing, in any material degree, the flavour, or efficacy of the water; but, where the original form of the medicine is to be adhered to, they may be put in.

*The king's honey water.*

Take, of good French brandy, one gallon, of the beſt virginian honey and coriander ſeeds, each one pound, of cloves, one ounce and half, of nutmegs, benjamin, and ſtorax, each one ounce, of vanilloes, in number four, and the yellow rind of the peel of three large lemons: bruiſe the cloves, nutmegs, coriander ſeed, and benjamin: cut the vanilloes into ſmall pieces: and put all together into a cucurbit; and pour the brandy on them: after they have digeſted forty eight hours, diſtil off the ſpirit into a retort with a gentle heat.

To one gallon of this water, add of damaſk roſe water, and orange flower water, each

one

one pound and a half; and of muſk, and ambergriſe, each five grains; firſt grind the muſk and ambergriſe well with ſome of the water; and afterwards put all together into a large mattraſs: ſhake them well; and let them circulate, three days and nights, in a gentle heat; and then let all cool: filter, and keep the water well ſtopt in phials for uſe.

*Note.*

This is the original proceſs for the king's honey water, which Wilſon the chemiſt introduced into vogue as a medicine: it has ſince continued in uſe; and is now eſteemed; but, principally, as a perfume; which end it elegantly anſwers. The multiplicity of ingredients, many of them inſignificant, are now, however, generally retrenched; and even the honey, the former baſis of the preparation, intirely left out of it. As the alterations have been made in this water, by many of the preparers, according to their own fancy; there can be no recipe given for any certain kind as generally uſed; but the following method will, if perſued, produce a water equal to any hitherto made of this kind.

*Method*

*Method of preparing an odoriferous ſpirit of the kind ſame with thoſe now ſold under the name of the king's honey water.*

Take, of coriander ſeed, and yellow rind of lemon peels, each half a pound, of caraway ſeeds, four ounces, of cloves half an ounce: bruiſe the ſeeds, and cloves; and put them, with the lemon peel, into a gallon of very clean proof ſpirit; and, after having let them infuſe for two days, add water ſufficient to prevent an empyreuma; and diſtil off one gallon.

To the aromatic ſpirit, thus obtained, add of damaſk roſe water, and orange flower water, each one pint; and take of muſk, and ambergriſe, each ſix grains; and, having ground them well to a paſte, with ſome of ſpirit, tie them in a linnen rag; and infuſe them, three or four days in the ſpirit, in a gentle heat; preſſing very ſlightly the rag ſeveral times during the infuſion.

*Note.*

The Jamaica pepper may be ſubſtituted, in the preparation of this water, inſtead of the cloves,

cloves, and nutmegs; but, as the quantity is but ſmall, the difference ſaved is not very material. An ounce or two of honey may be, likewiſe, diſſolved in part of the orange flower or roſe water; and being freed from the dregs, may be added to the ſpirit; which will impart a perceptible ſmell of honey to the whole, in a degree greater than the diſtilling the water from the honey can produce; and this, giving a ſlight clammineſs to the ſpirit, fixes the ſcent, and renders it more permanent than when the ſpirit contains none but volatile ingredients.

### *Anhalt water.*

Take, of the beſt turpentine, half a pound, of olibanum, one ounce, of aloes-wood, powdered, three drams, of maſtick, clove-july flowers, (or roſemary flowers,) nutmegs, cubebs, or galangals, and cinnamon, each ſix drams, of ſaffron two drams, of fennel ſeeds, and bay-berries, each half a dram: powder them; and, adding five pints of ſpirit of wine, digeſt them, for ſix days, with fifteen grains of muſk, incloſed in a ſmall linnen bag: then diſtil ſlowly, in balneo; and ſeparate the clear part of what comes over from the turbid.

*Note.*

Inſtead of the crude turpentine, two ounces of the oil may be, with more propriety, uſed. The maſtick, cubebs, galangal, ſaffron, fennel ſeeds, and bay-berries, affording either nothing by diſtillation, or what contributes very little, either to the odour or efficacy of the ſpirit, may be beſt omitted: the fennel ſeeds, particularly, are exceptionable, as depraving the ſcent.

*Eau de carmes, or aqua meliſſa compoſita.*

Take, of the freſh leaves of balm, four ounces, of the yellow rind of freſh lemon peels, two ounces, of nutmegs, and coriander ſeed, each one ounce, of cloves, cinnamon, and the root of angelica, each half an ounce: having bruiſed the leaves, and pounded the other ingredients, put them, with a quart of brandy, into a cucurbit; of which, ſtop the mouth; and ſet it in a warm place, to remain there two or three days: add then a pint of ſimple balm water; and ſhake the whole well together: after this diſtil guttatim in balneo, till the ingredients be left almoſt dry; and preſerve the water, thus obtained, for uſe.

*Note.*

The angelica root may be omitted; as it can impart nothing to the water by diſtillation.

In the place of the brandy, rectified proof ſpirit may be uſed.

By the ſimple balm water muſt be underſtood a ſimple water of the balm diſtilled with ſpirit: for if ſuch water were made without ſpirit; and added only to a quart of brandy, or proof ſpirit, in this preparation, and the materials diſtilled almoſt to dryneſs, the proportion of the aqueous fluid, to the vinous ſpirit, would render it ſo weak, as not to be capable of ſuſpending the eſſential oils of the ſpices, and other ingredients. It is, indeed, contrary to art, and abſurd, to uſe both the leaves of balm, and the ſimple water of it, in the ſame preparation, where a ſubſequent diſtillation is to be made; becauſe the augmenting the quantity of the leaves, and adding an equivalent proportion of brandy or ſpirit of wine, would anſwer the ſame end; but as there is not any water ordered to be uſed, to prevent an empyreuma, I ſuppoſe it was found, that with ſo large a bulk of the leaves, proportionably to the quantity of fluid, it was impracticable to avoid their burning. It would be much better, nevertheleſs, to add two more ounces of the leaves of the balm, and a pint of the brandy or proof ſpirit, inſtead of the pint of ſimple balm water; and, if enough of the ſpirit be made at one time to uſe the common ſtill, to add alſo a proper proportion of water to prevent the ſolid ingredients from burning

when the due quantity is come over; or otherwiſe to make the diſtillation in balneo, if the quantity of the ſpirit to be made be ſmall: by either of which means, uſed according to the circumſtances, an empyreuma may be avoided with the full proportion of leaves of balm to the whole ſpirit.

*Eau d'arquebaſſade, or vulnerary water.*

Take, of the leaves and roots of comfrey, of the leaves of ſage, mugwort, and bugle, each four handfuls: of the leaves of betony, ſanicle, and ox eye daiſy, the greater figwort, plantain, agrimony, vervain, wormwood, and fennel, each two handfuls; ſaint John's wort, long birthwort, orpine, Paul's betony, the leſſer centory, yarrow, tobacco, mouſe-ear, mint, and hyſſop, each one handful: cut, and bruiſe them well, in a mortar: then put them into a large earthen-veſſel; and pour twenty pints of white wine upon them; and ſtir the whole well together: cloſe up the veſſel; and digeſt, in a warm dung-hill, or ſimilar heat, for twenty days; then put the whole into an alembic of pewter or copper tinned; and diſtil off the fluid;

fluid; which, when thus obtained, is the Eau d'arquebuſſade; and muſt be preſerved in a cloſe ſtopped bottle.

### *Eau de luce.*

Take, of the oil of amber, half an ounce, or more, of ſpirit of wine dephlegmated with tartar, one or two pounds: put them into a bottle, and let them remain there, for ſome days; ſhaking them from time to time; and the ſpirit will be thus ſtrongly impregnated with the oil.

Take, then, what quantity you pleaſe of this impregnated ſpirit, or the whole, if you think proper: put it, with an ounce or two of the choiceſt amber, finely powdered, into a flaſk or bottle, and in a few days you will have a very rich tincture of amber. Theſe are the previous preparations for the mixture called l'Eau de luce; which is then to be made in the following manner.

Take, of the ſtrongeſt ſpirit of ſal ammoniacum, prepared with ſalt of tartar, one ounce, of the ſtrong tincture of amber, pre-

pared as above, two drams, of ſpirit of wine dephlegmated with ſalt of tartar enough to dilute and volatilize the mixture; that is, when the ſpirit and tincture are of the full ſtrength, five drams; which, when well mixed, give the genuine Eau de luce.

Thoſe, who deſire to have it perfumed, muſt mix lavender, or Hungary water, with the other ingredients, inſtead of the dephlegmated ſpirit of wine.

*Note.*

This proceſs for the Eau de luce is, like moſt other of the French recipes for the preparation of ſingular medicines, very abſurd and erroneous.

With reſpect to the ſpirit of wine, it is neceſſary for this purpoſe, that it ſhould be highly rectified; becauſe, otherwiſe, when it is lowered with the water in the ſaline ſpirit, it will be rendered below proof; and, conſequently, not capable of ſuſpending the oil of amber: but the dephlegmating with ſalt of tartar is not particularly material any other way than may regard convenience of method, as it does not give it any power of diſſolving the oil of amber not common to any ſpirit rectified to equal ſtrength.

The attempt to diſſolve the amber, by ſpirit of wine impregnated by the oil, is a groſs error;

ror: for whoever will make the experiment will find, that not the minuteſt quantity of amber will be diſſolved by this impregnated ſpirit: nor, perhaps, by any other menſtruum whatever hitherto known. This part of the proceſs is, therefore, wholly needleſs and impertinent.

The volatile ſpirit uſed ſhould not be very ſtrong of the volatile ſalt: for, otherwiſe, the greateſt part will be immediately ſeparated; as the addition of ſpirit of wine has this general effect on volatile ſpirits, by weakning the water as a menſtruum of the volatile ſalt.

The quantity of the volatile ſpirit muſt be proportioned, therefore, to the ſtrength of the ſpirit of wine: and muſt be leſs than one half, where the ſtrongeſt ſpirit is uſed, otherwiſe the oil of amber will ſeparate from the mixture.

The Eau de luce may be, therefore, better prepared, according to the very principles on which the above proceſs is founded, in the following manner.

### *More expedite manner of preparing the Eau de luce.*

Take, of the higheſt rectified ſpirit of wine, either dephlegmated by the addition of ſalt of tartar, according to the directions given p. 145, or by diſtillation, one quart, of oil of amber once rectified, one

ounce: put them together into a bottle; and let them ſtand ſome days, often ſhaking the bottle: then decant off the ſpirit from the oil remaining undiſſolved; and add four ounces of volatile ſalt of ſal ammoniacum diſſolved in a pint of water.

If, on the mixture, the oil of amber appear to ſeparate from the ſpirit, which will be ſeen by a white milky cloudineſs, add highly rectified ſpirit of wine to it gradually, till the whole become clear; and, if the volatile ſalt appear to ſeparate, which may be perceived by the production of a great number of very white ſhining particles in the fluid, let it ſubſide, and pour off the ſpirit from what is thus ſeparated: for it is certain, from the nature of the ſeparation itſelf, that a ſufficient quantity of the ſalt remains.

If it be deſired to have the Eau de luce perfumed, a dram of the oil of roſemary or lavender, or a mixture of both, may be added to the ſpirit of wine impregnated with the oil, before the addition of the volatile ſpirit to it.

*Note.*

*Note.*

By thus adjuſting the proportion of the ingredients, according to their real power of action on each other, by which, a combination of them may be made, this preparation may be perfected without the miſcarriages, to which the above proceſs is unavoidably liable, from its error with reſpect to the relative quantity of ſome of the ingredients, and its uncertainty with regard to others: and it will, notwithſtanding the apparent variation, be exactly the ſame, as it would if the directions of the former proceſs were perſued, ſo as to produce a due mixture of the ſubſtances employed.

It is the practice in ſome ſhops of London, to aromatize the ſpirit of wine uſed for the Eau de luce; by diſtilling it previouſly from cinnamon, mace, nutmegs, and other ſpices: but this is a variation from the original proceſs; and no improvement of the water, either as a medicine, or a perfume.

# PART III.

Of galenical preparations, where deviations are uſually made from the preſcriptions of the college; or where ſophiſtications are frequently practiſed.

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*Confectio cardiaca.*

TAKE, of freſh roſemary tops, and juniper berries, each one pound, of leſſer cardamom ſeeds, huſked, zedoary, and ſaffron, each half a pound: make a tincture of them, in about one gallon and a half of proof ſpirit; ſtrain off the tincture; and reduce it, by a gentle heat, nearly to the weight of three pounds and a half; then, adding the following ingredients finely powdered, make them into an electuary; of the compound powder of crabs claws, ſixteen ounces, of cinnamon, and nutmegs, each two ounces, and of the fineſt ſugar, two pounds.

*Note.*

This is the confectio cardiaca of the college of London; which is ordered to be made in the place of the confectio Raleighana: how far it is a proper ſubſtitute, for that laborious preparation; or with what propriety it is compoſed to anſwer the medicinal intention of its uſe, it is not my buſineſs to inquire here: but as there is an error in the proportion of the ingredients, which renders its conſiſtence very incommodious, even for preſent uſe, and improper with regard to keeping good the medicine for any longer ſpace of time, it may be no uſeleſs part of this work, to point out the defects of the preſcription, with reſpect to the form of the medicine; and to ſhow where they may be remedied. The principal fault lies in making the quantity of the fluid of the extract far too great, for the proportion of the powders and ſugar: for, as the extract gains very little tenacity from the ingredients, which are the ſubject of it, the powders, finding little or no viſcidity to ſuſpended them, neceſſarily ſink to the bottom; and, this ſeparation of the ingredients renders it very difficult, conſequently, to meaſure out doſes, which may contain equal proportions of them; and, what is ſtill much worſe, the proportion of ſugar, not being one third of what is found neceſſary, in order to the preventing fermentation in ſyrups, (for the quantities directed by the college themſelves

ſelves for ſyrup are two pounds of the ſugar to one of the fluid; whereas, there is here only two pounds of the ſugar to three and a half of the fluid) the medicine is, conſequently, ſpoiled by its fermenting, as ſoon as the warmth of the ſeaſon diſpoſes it to that ſtate: and, as it neither can be made in very ſmall quantities, nor is of ſo frequent uſe, as to render the renewing the ſtock very often practicable, this quality occaſions a very great loſs to thoſe, who prepare it according to the above preſcription.

It is neceſſary, therefore, to change the conſiſtence of this medicine, without altering the proportion of the ingredients; which might be done by waſting the fluid to one pound: but then every doſe preſcribed would be, vertually, almoſt one third greater than it ought, according to the original form: to avoid which inconvenience, as well as that ariſing from a cloſe adherence to the preſcription, the moſt proper method is to waſte a ſmall part of the fluid; and to add an equivalent proportion of ſome other ſubſtance, which may contribute to inſpiſſate the remainder in ſuch manner, that the powders may be duly ſuſpended, and the aptitude to fermentation at the ſame time removed. This may be affected by gum arabic or ſtarch previouſly boiled; which will produce the deſired effect without interfering in the leaſt degree with the efficacy of the medicine.

The ſpirit of wine in the above preſcription is ordered to be evaporated: but that is a needleſs waſte of it, as well as of the oil raiſed from the

the roſemary; which, by a proper treatment, would produced ſix pints of Hungary water, without the leaſt difference to the extract, if the ſpirit of wine be divided into two proportionable parts, and the roſemary tops diſtilled with one part ſeparately, and the other ingredients with the other: nor will that part of the ſpirit, diſtilled from the juniper berries, &c. be rendered of no value by the admixture of what riſes from thoſe ingredients: for it will be converted into one of the beſt and moſt palatable kinds of Geneva, that can be imagined.

The following method, therefore, of preparing the confectio cardiaca will be found very advantageous; and productive of a due conſiſtence of the medicine, without in the leaſt altering either the proportion or quality of the ingredients.

*More profitable method of preparing the confectio cardiaca; without the defects found in it, when made according to the form of the college.*

Take, of freſh roſemary tops, one pound: add to them ſix pints of proof ſpirit, and one quart of water, to prevent an empyreuma: put them into a proper alembic; and diſtill off ſix pints.

Take,

Take, alſo, of juniper berries one pound, of the leſſer cardamom ſeeds huſked, zedoary, and ſaffron, each half a pound: add to them another gallon of proof ſpirit; and, after digeſting ſome time, put them, alſo, into a proper alembic, with a quart of water, and diſtill off one gallon.

Put what remains, after both the diſtillations, together into a proper veſſel; and evaporate it, till there remain only three pounds; adding, in the mean time, of gum arabic two ounces, and of ſtarch one ounce; diſſolve, then, in this extract, two pounds and a half of ſugar; and, laſtly, mix with it, the ſugar being firſt diſſolved, a powder compounded of ſixteen ounces of crabs claws, two ounces of cinnamon and nutmeg, and one ounce of cloves.

*Note.*

By this reduction of the quantity of the fluid, and inſpiſſating the remainder by the gum arabic and ſtarch, together with the augmented quantity of the ſugar, the compoſition is rendered of the due conſiſtence of an electuary, without altering the weight of the whole, or changing the proportion of any of the ingredients; except

cept the ſugar, of which, the half pound, to allow for the evaporation of part of the fluid, cannot be ſuppoſed to make any difference in the efficacy of the medicine.

By diſtilling the roſemary with the proportion of ſpirit of wine here directed, ſix pints of Hungary water is gained without the leaſt injury to the extract: as is, likewiſe, by the ſame means, a gallon of Geneva, equal to the beſt made in Holland, for the additional expence of half a gallon of proof ſpirit.

## *Gaſcoign's powder.*

Take, of prepared pearls, crabs eyes, red coral, the whiteſt amber, calcined hartſhorn, and oriental bezoar, each one ounce: of the tips of crabs claws powdered, the weight of all the others: make them into a fine powder; and afterwards form them into balls, by means of a ſolution of gum arabic.

### *Note.*

This compoſition, which, from the caprice and folly of mankind, has been in very great vogue, differs materially from other teſtaceous powders in nothing, but the very great expenſiveneſs of ſome of its ingredients. It has, therefore, been ſeldom prepared with a ſtrict conformity to the preſcription here given; which

which is that of the former edition of the Dispensatory of the London college; but altered, according to the fancy or parcimony of the preparers; and now most frequently excluded from the shops by the substitution of a counterfeit mixture, which does not contain even one of the proper ingredients. But before I give the recipe for this absolute counterfeit, I will give one for such, as avoiding the most costly of the ingredients, at the same time comprehends all that are materially necessary.

*Cheaper method of preparing Gascoign's powder without altering its efficacy.*

Take, of crabs claws seven ounces, of calcined hartshorn, and amber, each one ounce, of the seed of the amomum Plinij, dried and powdered, two drams: all the ingredients being levigated together, make the mixture into balls, by a solution of gum Arabic.

*Note.*

The crabs claws being no way different, with regard to their medicinal virtue, from the pearls, coral, or crabs eyes, the quantity of it is increased to supply their place; and the seeds of the amomum, which have been discovered to give the colour when rubbed on paper, which was made the test of the genuineness of this

medicine, is, on that account, added in the place of the bezoar: and this compoſition is in fact equally good with that prepared in the moſt expenſive manner, as all the bodies of the teſtaceous kind have the ſame qualities; and coral, though differently produced, has a ſtrict affinity with them. But cheaply as this may be prepared, the common ſubſtitute, above-mentioned, for the Gaſcoign's powder deviates wholly from it; being compoſed of ſubſtances varying even from the nature of the true ingredients; as it is compoſed of foſſile earths, inſtead of the teſtaceous parts of animals; and, therefore, according to what we before obſerved in the introductory part, eſſentially different. But that the impoſition may be the better known, I will give here the recipe for the preparation.

*Method of preparing the counterfeit Gaſcoign's powder commonly ſold.*

Take, of chalk, one pound, of tobacco-pipe clay, dried and powdered, half a pound, of the ſeed of the amomum Plinij, half an ounce: levigate them well together; and form them into balls.

*Note.*

This clumſy mixture has ſo much the appearance of the Gaſcoign's powder, that from the reſemblance, and the cheap price it is ſold for

for by thoſe who prepare it, (which I believe is not more than four or five ſhillings per pound,) it has become the common ſort uſed; eſpecially in the country where preparations of this kind are generally had from druggiſts, who neither know nor care any thing more about medicines, than where ſuch as are paſſable may be moſt cheaply purchaſed.

As it is of ſome conſequence, therefore, to be able to diſtinguiſh this counterfeit from the other kind, I would adviſe the putting a ball of any ſuſpected into the fire; which, if it be compoſed of tobacco pipe clay and chalk, will harden; but, if of the teſtaceous ſubſtances proper to the medicine cemented together with gum Arabic, will grow ſoft and crumbly: the gum Arabic which cauſed the tenacity, being deſtroyed by the fire, and the teſtacea calcined.

*Goa ſtone.*

Take, of hyacynths, topazzes, ſapphires, rubies, and pearls, each an ounce, of oriental bezoar, white coral, and red coral, each two ounces, of emeralds, half an ounce, of muſk, and ambergriſe, each two drams, of leaves of gold, number forty: let all be levigated into an impalpable powder; and, with roſe-water, made into a paſte; which is to be formed into long or oval balls, and poliſhed.

*Note.*

The great expenſiveneſs of the precious ſtones in this preparation, from which, likewiſe, it receives not the leaſt addition to its efficacy, has occaſioned ſubſtitutions of various kinds to be made for it: in which, alſo, the admixture of the leaf gold, with the other ingredients, has been omitted; as it was no way neceſſary, but for the gilded appearance, that may be equally well produced with a much leſs quantity uſed differently.

The Goa ſtone, therefore, according to the preſent uſage of the ſhops, may be prepared in the following manner.

*Method of preparing the Goa ſtones, as they are now found in the ſhops.*

Take, of crabs claws levigated, eight ounces, of oyſter ſhells levigated, four ounces, of muſk, and ambergriſe, each two drams: mix them well; and make them into a paſte with roſe water, in which gum arabic is diſſolved, in the proportion of a dram to two ounces: make this paſte into round or oblong balls; and, when they are dry, dip them in a ſtrong ſolution of gum arabic; and roll them on leaves of gold, till their ſurface be wholly covered; and,

when again dry, rub them with a cloth to give them a poliſh.

### *Volatile tincture of bark.*

Take, of the Peruvian bark, four ounces, volatile ſpirit of ſal ammoniacum, two pints, digeſt them, without heat, in a veſſel well cloſed; and ſtrain off the tincture.

### *Note.*

The college have directed no volatile ſpirit to be made but with fixt alkaline ſalt; and wholly prohibited the uſe of lime for that purpoſe: now this tincture cannot be made of any volatile ſpirit but what is prepared with lime; for with the ſpirit made by fixt alkaline ſalts, nothing can be produced but a thick mucilage from the infuſion of the bark: from which circumſtance, many, who have attempted to make this tincture, have miſcarried; and found it impracticable.

Whoever, therefore, would prepare this medicine, muſt uſe volatile ſpirit of ſal ammoniacum made with lime, inſtead of that made by fixt alkaline ſalt.

### *Balſam of ſulphur.*

Take, of olive oil, one pound, of flowers of ſulphur, four ounces: put them into a

pipkin, that will contain about three times their quantity; and ſet it over a fire, and make the matter boil gently: keep it continually ſtirring, with a wooden ſpatula, for the ſpace of an hour and half, till it is quite cool: and put it up for uſe.

*Note.*

This is conformable to the preſcription of the college of London: but the medicine is generally made in a cheaper manner; by ſubſtituting the linſeed oil inſtead of that of olives; by increaſing the quantity of ſulphur; and by uſing the crude or roll ſulphur inſtead of the flowers: for which method of preparation this is the general proceſs.

*Common method of preparing balſam of ſulphur.*

Take, of linſeed oil, one gallon, and of crude, or roll ſulphur, four pounds: put the oil into an earthen pipkin, which will hold about two gallons; and ſet it over a fire, that will only make it boil in the moſt gentle manner: powder the ſulphur; and throw it, gradually, into the boiling oil; at firſt in greater quantities, and afterwards more gradually; ſtirring the mixture, with a wooden ſpatula;

ſpatula; and letting one quantity be diſſolved before another be added; when the whole quantity of ſulphur is diſſolved, the preparation is finiſhed.

*Note.*

By this means, the balſam of ſulphur is prepared at a very ſmall expence: and, though in the moſt regular manner the coſt is ſo little, that there ſeems no temptation to deviate from it; yet the farriers, who make the principal demned for it, uſe it in ſuch large quantities, that the greatneſs of the conſumption makes it worth while for the wholeſale dealers to conſult of ſuch ſavings, as are made by this proceſs.

With reſpect to its uſe in regular medicine, the ſubſtitution of linſeed, for olive oil, is not very exceptionable: there is indeed ſo little apparent foundation, for a preference of either, that the college of Edinburg have left it wholly to the choice of the preparer, which to employ.

The uſe of crude ſulphur, inſtead of the flowers, is not much more to be objected to; for they differ only in purity: and, if the roll ſulphur be good, no difference will be found in the medicine.

As to the efficacy of the medicine, one would imagine, that the increaſe of the quantity of ſulphur would be rather beneficial than other-

wiſe: as the oil can only be conſidered, as the vehicle of it. The only reaſon, therefore, of limitation of the proportion, ſeems to be; that, if too much ſulphur be added, the fluid form of the mixture, which it will retain with this quantity, is apt to be deſtroyed: as I have frequently ſeen, where a yet greater quantity of ſulphur than is here directed has been uſed: and this renders it incommodious to take out of the veſſels when it is ſold, or uſed.

## *Acid elixir of vitriol.*

Take, of cinnamon ſix drams, of leſſer cardamom ſeeds huſked, three drams, of long pepper, and ginger, each two drams: infuſe without heat; and filter off the tincture: to this add of oil of vitriol, ſixteen ounces; and filter.

### *Note.*

This medicine is ſeldom prepared for ſale according to the preſcription of the college here given, the quantity of the ſpices being ſo ſmall, that they neither produce the reſemblance, in ſcent or colour, of the former elixir; and therefore, render this compoſition leſs agreeable to thoſe, who are accuſtomed to the other.

The former preſcription of the college ordered twelve ingredients to be uſed, beſides the ſpirit

ſpirit of wine, and oil of vitriol; but a great part of them, being unneceſſary; and ſome of them abſurd with reſpect to the intention, are generally omitted; and other proportions of the remaining are employed in their ſtead: the Jamaica pepper has been ſubſtituted by ſeveral inſtead of ſome of the dearer ſpices; not being eaſily diſtinguiſhable, in the tincture, from them. The eſſential oils of ſage and mint have been ſome times uſed, inſtead of the leaves; and are now ordered by the Edinburg college: but, as the London college wholly omit both, the following recipe, if any ſubſtitution be allowed, may be conſidered as one of the beſt; as, by it, not only a ſtrong tincture for the elixir is made, very cheaply, but the compoſition is greatly correſpondent to the above preſcription; at the ſame time the appearance of the medicine will be rendered very conformable to that of the old eſtabliſhed elixir.

*Cheap method of preparing the elixir of vitriol, in the moſt perfect manner.*

Take, of proof ſpirit of wine, two pints, of Jamaica pepper, one ounce and half, of caſſia lignea, and ginger, each one ounce: pound the ſpices; and put them, with the ſpirit of wine, into a mattraſs with a circulating head; and, after an infuſion of

ſeveral

ſeveral days, ſtrain off the tincture: to which add ſixteen ounces of oil of vitriol very gradually.

*Note.*

This tincture being much more rich of the ſpices, than that made according to the college preſcription, will have a much ſtronger ſcent; and acquire, after keeping ſome time, the red colour, which is produced by the action of the oil of vitriol on the eſſential oils of the ſpices, and is neceſſary for the ſaleable appearance of this medicine; and, if the ſpices can be ſuppoſed to add any efficacy to the compoſition, this muſt be preferable to that prepared by the regular proceſs; where the quantity in a doſe is ſo minute, that no poſſible effect can be expected from it.

*Sweet elixir of vitriol.*

Take, of cinnamon ſix drams, of leſſer cardamom ſeeds, huſked, three drams, of long pepper, and ginger, each two drams, of proof ſpirit of wine, two pints: infuſe without heat; and filter off the tincture: to which, add of ſpiritus vitrioli dulcis ſixteen ounces.

*Note.*

This is the prescription of the college of London, for the sweet elixir; and is, in fact, a substitution for Vigani's elixir of vitriol, which the college of Edinburg, omitting the green colour, have adopted as the only kind directed by them. But as the demand for Vigani's is yet continued, and the preparation of it kept as a secret in the hands of some particular people, I will here give the method of making it.

*Vigani's elixir of vitriol.*

Take, of the blades of green corn, or the leaves of spinage, a proper quantity: bruise them well, in a mortar of glass or marble; and then press out the green juice from them: put two ounces of this green juice, or as much as will raise the desired colour, into a pint of spiritus vitrioli dulcis; and add to it, dropping them in very gradually, of the oil of mint, two drams, of the oil distilled from lemon peels, and nutmegs, (or Jamaica pepper), each one dram: incorporate them thoroughly; and, if any small quantity of the oil remain unmixed, let it be taken away by means of a separating funnel.

Or,

Or, an ounce of Jamaica pepper, dried leaves of mint and lemon peel, the two firſt being powdered, and the laſt bruiſed, may be infuſed, with a gentle heat, for ſome days, in a pint of ſpiritus vitrioli dulcis coloured as above; and the tincture then poured, or ſtrained, off from the dry ingredients.

*Note.*

The green colour of this elixir is the ſecret, which has kept this preparation in particular hands; but it may be produced by the above means; or by infuſing the ſeeds of the amomum Plinij, in the ſpiritus vitrioli dulcis, together with ſaffron, or yellow ſanders.

*Daffy's elixir, or elixir ſalutis.*

Take, of jalap, one pound and half, of ſena, leaves, half a pound, of aniſeed, three ounces, of coriander ſeeds, two ounces, of orange peel, one ounce, of proof ſpirit of wine, one gallon: having powdered the jalap, and bruiſed the ſeeds, infuſe them for eight, or ten days; after ſhaking the veſſel.

*Note.*

The ſale of compoſitions under the name of Daffy's elixir, being very great, many perſons have

have made the preparation of it, with a few other things of a like kind, their particular buſineſs; and all methods have, therefore, been tried to prepare it as cheap as poſſible. The principal view is to have a cheap purgative joined to the aniſe and coriander ſeeds, inſtead of the uſing the ſena alone; and this is beſt done by the jalap; which neither gives the bitter flavour, nor is apt to gripe, as the aloes, its rival in cheapneſs. This preſcription may, therefore, be eſteemed the beſt for the Daffy's elixir, both for the palatableneſs and mild efficacy: and the proportion of the purgative ingredients is nearly correſpondent to that of the college tinctures.

## *Syrup of capillair.*

Take, of maiden hair, one ounce, of liquorice ſlipped into thin bits, two ounces: pour upon them a quart of boiling water; and let them infuſe in it one day: then ſtrain off the fluid through flannel; and diſſolve in it, being ſet on the fire in a proper veſſel to boil; four pounds of eightpenny ſugar; taking off the ſcum as it riſes: as ſoon as the whole of the ſugar is diſſolved, and the ſyrup has boiled eight or ten minutes, take it off the fire: and, when cold,

cold, add two ounces of orange flower water; mixing it well with the ſyrup by ſtirring, or ſhaking them together.

*Note.*

The conſtant uſe of this ſyrup at coffee-houſes, and elſewhere, as a regale, has occaſioned it to be prepared in the cheapeſt manner that could be contrived; which has been firſt by uſing only the ſyrup of ſugar, and a little orange flower water; and afterwards omitting even two or three parts of the proper quantity of ſugar, and thickning the ſyrup with ſtarch, in order to make it appear of the due conſiſtence, and to prevent its fermentation, which would otherwiſe neceſſarily happen. But thoſe who are not diſpoſed to enter into ſuch fraudulent practices, and would prepare this ſyrup genuinely cheap, may uſe the above preſcription; which differs only from the officinal ones in leſſening the quantity of the maiden hair, that, in a greater proportion, would render the ſyrup bitter and unpalatable.

PART

# PART IV.

## Of the ſubſtitutions and adulterations, commonly practiſed with reſpect to the ſimples; and the proper methods of detecting them in each inſtance.

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### *Adulteration of quickſilver; and the means of its detection.*

QUICKSILVER, though of at leaſt equal importance with any other medicinal ſimple, is, perhaps, more frequently adulterated than any other: and, by that means, rendered greatly unfit for thoſe preparations, where it does not undergo a ſublimation; as in the ſeveral precipitates, æthiops mineral, and alcaliſate mercury.

The adulteration is made by amalgamating lead or tin with the quickſilver; which metals it readily diſſolves, and apparently aſſimilates with itſelf.

As this adulteration, particularly with lead, ought to be carefully guarded againſt, where quickſilver is uſed for the abovementioned

tioned purpoſes, it ought always to be proved by a proper teſt.

The eaſieſt means of doing this, where the adulteration is great, is by ſtraining it through leather; in which, if it contain beyond a certain proportion of lead or tin, a paſty metallic matter will be left; being an amalgama of the two metals: but, if the adulteration be ſmall, this proof will not diſcover it; and the following method ſhould be uſed.

Put any quantity of the quickſilver ſuſpected into a crucible; and give it ſuch a heat, as will diſſipate it in fumes: after which the tin or lead, if there be any, will be left in the crucible; and being examined and weighed, not only the nature, but the proportionate quantity of the adulterating matter in the quickſilver, may be with certainty known: ſo that, the quickſilver may be either purified for the uſes, which require it, according to the means directed p. 208; or applied to the purpoſes where purity is not eſſential; proper allowance being made for the defect in quantity

of

of the real quickſilver, proportionably to the weight cauſed by this adulteration.

*Subſtitution for native cinnabar.*

The native cinnabar bearing a conſiderable price, the factitious cinnabar, which, when prepared with a great proportion of ſulphur, extremely reſembles it, is very frequently ſubſtituted for it.

As they are in fact the ſame, the native cinnabar, as well as the factitious, being only a combination of quickſilver and ſulphur, and that, likewiſe, in various proportions in different parcels, there is no poſſibility of diſcovering this ſubſtitution: and it is beſt, therefore, to avoid the uſe of this ſubſtance as a medicine; and to be ſatisfied with the factitious under its own name; as there can be no certainty, in the common courſe of practice, of having the genuine native; and as, when it is had in the moſt genuine ſtate, it is no way different from the factitious, but in the manner of its production.

*Adulteration of white lead, or ceruſs; and the means of its detection.*

White lead, though of ſmall price, yet being conſumed for the purpoſes of painting in great quantities, is, for the moſt part, adulterated by the manufacturers, or wholeſale dealers in it; and, in this ſtate, conſequently, procured for the moſt part as a ſimple in medicine.

The common adulteration is with chalk or talc; as being the cheapeſt ingredients, with which it can be ſophiſticated: this, in a leſſer degree, is of no great moment with regard to the medicinal uſes of this ſubſtance, which are principally for the making plaiſters, or unguents. But, in a greater proportion, ſuch mixtures of heterogeneous matter deprave it highly for ſome applications.

The adulteration may be, therefore, examined moſt eaſily, by comparing a piece of what is ſuſpected with another piece, known to be pure, of equal bulk; and the difference of weight will ſhew the fraud,

fraud, where the ſophiſtication is in a great proportion. But, where the quantity of adulterating matter is leſs, or the proportion of it would be more exactly known, the following manner ſhould be uſed.

Take an ounce of the white lead ſuſpected; and mix it well with about half an ounce of pearl-aſhes, or of any fixt alkaline ſalt, and about a quarter of an ounce of charcoal duſt; and, having put them into a crucible, give them a ſtrong heat. The lead will, by this means, be reduced, to its metallic ſtate; and, being weighed, will ſhew, by what it may fall ſhort of the weight of an ounce, the proportion of the adulteration: about a tenth part being allowed for the corroding acid of the white lead.

### *Adulteration of red lead, or minium; and the means of its detection.*

The red lead is neither ſo frequently nor largely adulterated as the white: becauſe of the viſible effect any admixture of ſuch in-

gredients as are of leſs value would have on its bright colour. It is, however, ſometimes adulterated with red oker; which may be perceived, by comparing the ſophiſticated with a ſpecimen of the true, from the foulneſs which will be produced in the bright orange colour. But any adulteration may be with certainty known by reducing it to its metallic ſtate, through the means above given for the white lead: the pearl-aſhes being in this caſe omitted.

### *Subſtitution for gum arabic.*

The gum ſenegal, which can be afforded at a much cheaper rate, is very frequently ſold or uſed for medicinal purpoſes in the place of the gum arabic: but as they are, as far as appears, alike in their qualities with reſpect to their uſe in medicine, it is not a very hurtful fraud.

As it is proper, however, to prevent impoſitions with reſpect to price, that they ſhould be diſtinguiſhed: whoever has occaſion may diſcern the difference, by the dry and brittle conſiſtence of gum arabic; the

the other being clammy and tenacious, like the gums produced, in our own country, from the plumb or cherry trees.

*Subſtitution for the true ſperma cæti.*

The form and conſiſtence of ſperma cæti not being owing to the ſtate or nature of the oil, of which it is made, when taken from the whale, but to an artificial concretion produced by the addition of ſaline bodies, the ſame art is practiſed on other animal oils; even on the moſt feculent part of the train oil, and that extracted from pilchards; and the fictitious ſperma cæti, thus prepared, is ſold, and uſed, in common, with that prepared from the proper part of the fat of the whale.

As, however, the nature of animal oils is the ſame in all reſpects, except with regard to conſiſtence, and their ſweet or putrid ſtate, and as all ſuch oils are rendered alike ſolid and ſweet, by that treatment of them, by which the ſperma cæti is prepared, the ſubſtitution of train, or other oils, inſtead of that originally uſed, cannot be accounted

an injurious fraud, with reſpect to medicine; and, with reſpect to other purpoſes, it will be a very valuable improvement.

*Subſtitution for cinnamon.*

The caſſia lignea is, for moſt purpoſes, ſubſtituted for cinnamon, by thoſe who ſtudy the cheap preparation of medicines: it is, likewiſe, very frequently mixed with the true cinnamon; and ſometimes ſold intirely for it.

With reſpect to the medicinal efficacy, this ſubſtitution may be conſidered as allowable: for there is no experimental difference to be found in the eſſential oils (in which alone the efficacy of this drug lies) betwixt the two kinds: and a very ingenious gentleman, whoſe veracity cannot be queſtioned, after having particularly taken upon him to inquire after this matter in the Eaſt Indies, is ſatisfied, that they are the bark of the ſame tree; and only differ in the manner of curing, and the choice with regard to the parts and age of the tree.

The

The caſſia, however, as it is here imported, may be eaſily diſtinguiſhed from the cinnamon, by thoſe who have occaſion, from a ſweet mucilage, which it affords on taking it into the mouth, where it ſeems, if good, almoſt wholly to diſſolve: whereas the cinnamon taſtes hotter; and has a bitter dryneſs in the mouth: the caſſia, likewiſe, ſhews itſelf, when infuſed in ſpirit of wine, by imparting a ſtrong yellow colour to it, not found in near ſo great a proportion in the cinnamon: the quills of the cinnamon bark are, likewiſe, generally much thinner and ſmoother than the caſſia.

## *Adulteration of vinegar; and the means of its detection.*

Vinegar prepared in the great works near London is generally adulterated with oil of vitriol. This ſophiſtication does not, however, greatly injure it for medicinal uſes, when it is not in a great degree: but where, as I have ſeen it, a conſiderable part of the acid is only from the oil of vitriol added,

the uſing ſuch for diſtillation, or for making the ſugar of lead, and ſeveral other purpoſes, is attended with great loſs and inconvenience.

In order, therefore, to diſtinguiſh the vinegar ſo adulterated from the purer, where the taſte is not thought a ſufficient evidence of this fraud, the following method may be uſed.

Take a quart of the vinegar; and boil it down to about two ounces: into the remainder, put two drams of any fixt alkaline ſalt: which, being diſſolved, pour on two or three ounces of water; and filter the ſolution: evaporate, then, the fluid to about half an ounce; and, if there were any oil of vitriol in the vinegar, chryſtals of the vitriolate tartar will be found; which may be eaſily known by their taſte, or peculiar form ſimilar to that of the mineral chryſtal, only with a greater thickneſs proportionably to their length.

The reſiduum in the retort, or veſſel, after the diſtillation of vinegar may be uſed for this trial inſtead of the vinegar itſelf: by which

which means the evaporation may be ſaved; and, as a conſiderable quantity may be this way uſed without expence, the proportion of the oil of vitriol may be nearly aſcertained by the quantity of tartar vitriolate produced, which may be ſeparated, from the ſal diureticus that will be formed from the remaining part of the acetous acid, by a careful chryſtallization.

### *Sophiſtication of ſaffron.*

The foreign ſaffron is almoſt conſtantly ſophiſticated with oil; by which means the weight is increaſed in a great diſproportion to that of the pure ſaffron; and the flavour of it, alſo, frequently depraved. It is uſual, moreover, for dealers in medicine to prepare the foreign ſaffron, by extracting the oil from it, and preſſing it into cakes of the ſame form with thoſe of the Engliſh; and to paſs it off for the Engliſh; to which it is greatly inferior in all reſpects.

This impoſition cannot be diſcovered by any other means, than the learning the true appear-

appearance of the beſt ſaffron, or the keeping a good ſpecimen to compare with any that may be queſtionable: where the ſtrong aromatic ſmell, and deep clear colour, will eaſily ſhew the difference betwixt the foreign and Engliſh.

### *Adulteration of pearl-aſhes.*

The pearl-aſhes, which both from the adoption of them by the college, and their frequent uſe in the chemical practice, are now become a material ſimple, are, for the moſt part, adulterated with ſea-ſalt in a greater or leſs degree. As the ſea ſalt is of an innocent nature, there is no great miſchief ariſes from this, when in a moderate degree: but where the adulteration is great, a loſs ariſes from the deficience of the fixt alkaline ſalt, in the preparations where the pearl aſhes are uſed. In order, therefore, to guard againſt the taking any ſuch, it is very proper to try them, by laying a little on a red-hot poker; where, if any quantity of ſea ſalt has been added after the pearl aſhes have been calcined, it will inevitably

ſhow

ſhow itſelf by its decrepitation or crackling noiſe.

*Subſtitution for pearls.*

It is uſual, where prepared pearls are to be uſed or ſold, to ſubſtitute prepared oyſter ſhells in their place; which, when reduced to impalpable powder, are indiſtinguiſhable from them, being in fact the ſame ſubſtance; for which reaſon it were to be wiſhed that the college had thrown them out of the materia medica in the late reformation of their pharmacopeia: and that the credulity in old forms did not give ſo much occaſion to impoſition of this kind; which, however innocent with reſpect to the medicinal conſequences, are yet a ſort of commercial fraud, that will be unavoidably practiſed, while authority countenances the preſcription of ſubſtances very ſcarce or dear, which have others reſembling them in appearance, and agreeing with them in their qualities.

*Subſtitution for crabs eyes.*

As prepared oyſter ſhells are ſubſtituted for pearls, ſo crabs claws are, for the moſt

part, ſold or uſed, where crabs eyes are demanded or ordered; and for the ſame reaſon: there being, in fact, no difference betwixt them, but the form in which, and ſituation where, they are produced in the crab.

Theſe ought, therefore, along with the pearls and other ſuch ſubſtances as have no eſſential ſuperiority over the reſt of the genus to which they belong, and are difficult to be collected, or of great price, to be excluded from the materia medica: by which means, the preparers of medicines would not have their conſcience forced by the temptation, the opportunity of practiſing the arts of ſophiſtication and ſubſtitution gives, while coſtly medicines are in uſe: nor would the preſcribers or purchaſers be liable to ſuch deceptions; but certain in general of really having what they wrote, or paid, for.

*Subſtitution for the teſtacea in general.*

Chalk is very frequently ſubſtituted for, or mixed with, all the prepared teſtacea.

This

This is much leſs allowable, than the changing any of the teſtacea for each other; for, though chalk be, as well as the teſtaceous genus, of an alkaline nature; and will neutralize acids in the via prima to a certain degree; yet it will much leſs effectually do ſo than the others; and has, beſides, a ſtyptic aſtringent power, by which, it increaſes coſtiveneſs, in many habits, to a very detrimental degree.

The method of diſcovering where chalk is ſubſtituted for, or mixed with, the teſtaceous earths, is to pour oil of vitriol upon the ſuſpected quantity; which will readily diſſolve the teſtaceous earths, but leaves the greateſt part of the chalk unchanged; by which means, the fraud may be eaſily detected. But this is not practicable where the teſtacea have undergone a ſtrong calcination; for, being rendered of a calcarious nature, they have then a great affinity with chalk; and will reſiſt the ſolvent power of the oil of vitriol, when they are diveſted of their ſulphureous or phlogiſtic part.

Chalk

Chalk may be, likewiſe, diſtinguiſhed from the levigated teſtacea, by the taſte; which is much more auſtere and rough in the firſt, than in the others: but this criterion cannot be extended to a mixture of them, where the proportion of the chalk may be ſmall.

*Subſtitution for the buckthorn berries.*

The buckthorn berries being one of the moſt common cathartic medicines, and conſequently uſed in a conſiderable quantity, it is very frequent for thoſe, who collect them, to put off in their place, and intermix with them, the berries of other trees and plants; particularly thoſe of the frangula, or black alder, which greatly reſemble them in their appearance.

As this ought to be carefully guarded againſt, on account of the error it may occaſion in the ſtrength of the ſyrup of buckthorn, which is a medicine frequently much depended upon, it is proper to examine well ſuch parcels of berries, as are not had from the hands of thoſe who can be well confided

fided in: and the true buckthorn berries may be diſtinguiſhed, by their three cornered ſeeds, with a purpliſh juice intermixed with green.

The juice of the buckthorn berries, which is ſometimes bought of thoſe who gather them, and expreſs it to ſave the carriage of the berries, where they are to be diſpoſed of at a diſtance, is very liable, alſo, to be adulterated by the admixture of water, or any other fluid which may reſemble it. Againſt this there is no means of ſecurity, but the avoiding being concerned with the juice already extracted from the berries; and uſing them alone, as they may, generally, be as eaſily procured, as the juice, with a ſmall difference in the proportion of the price.

*Subſtitution for oil of cinnamon.*

The eſſential oils of the caſſia and cinnamon, (and probably the trees affording the barks) as we have obſerved before, being the ſame, the oil of caſſia is in general ſubſtituted for the other, it being now a common

mon practice at Bencoolen, and other places in the Eaſt-Indies, as well as in England, to diſtill it for that purpoſe.

As it is ſo much a doubt, whether there be any difference in nature betwixt them, there can conſequently be no artificial means of diſtinguiſhing them : nor for the ſame reaſon any juſt ground of ſollicitude about ſuch means.

*Subſtitution for oil of cloves; with the adulteration of the genuine.*

If Jamaica pepper be diſtilled, it affords an oil greatly reſembling that of cloves, both in its appearance, flavour, and ſcent. It is, therefore, frequently mixed with the oil of cloves ; and ſometimes put off for it.

There is no method of diſtinguiſhing this fraud, but by comparing a ſpecimen of pure oil of cloves with what is ſuſpected; and judging by the colour and ſcent ; the true oil of cloves being of a lighter orange brown colour, and a much higher aromatic ſmell, than that of the pepper ; which

which has a more thick black appearance, and fainter odour.

The oil of cloves is, likewiſe, frequently adulterated with the oil of olives, or of linſeed; which may be diſcovered by placing ſome of it, in a phial, in a cold cellar: where, on ſtanding at reſt, for a long time, the oil of cloves will ſhew itſelf ſeparated, by ſubſiding to the bottom. This fraud may, alſo, be diſcovered by dropping the oil of cloves into very highly rectified ſpirit of wine, and mixing them well by ſhaking; where, being attracted by, and combined with, the ſpirit, the oil of olives will ſwim on the ſurface, or appear in ſmall globules.

### *Adulteration of eſſence of lemons.*

The eſſence of lemons is frequently adulterated, as well as the oil of cloves, by the admixture of common oils. The fraud may be diſcovered, in the ſame manner, by its admixture with highly rectified ſpirit; or by diſtilling any quantity of it, in a ſmall retort, with water; where the eſſence riſing will be rectified; and leave the oil behind in

the retort, floating on the remains of the water.

*Sophiſtication of oil of lavender.*

The oil of roſemary having a ſcent, which has ſome affinity with that of lavender, as well as being like it with reſpect to colour and conſiſtence, and of a much lower price, is frequently mixt with it.

This is of no great conſequence, where the oil of lavender is uſed as a medicine, their nature being very much the ſame; but, where the impoſition may be thought of moment with regard to the price, it may be diſcovered, if not in a very ſmall degree, by comparing a ſpecimen of the genuine oil with that which is ſuſpected: when the bitteriſh and more oily ſcent of the roſemary will be a ſufficient means of diſcrimination to thoſe who have an acute ſmell.

*Subſtitutions practiſed with reſpect to rhubarb.*

The rhapontic is very frequently ſold, or adminiſtered, in the place of the true rhubarb;

barb; to which it is ſuppoſed to be inferior in its medicinal qualities.

The true rhubarb may be diſtinguiſhed from the rhapontic, by thoſe who are converſant with drugs, by the grain and colour: but the more obvious difference will be found on chewing: when the rhapontic diſſolves quickly, by means of the ſaliva, into a mucilage of a very tinging yellow colour; and affords an earthy and much more diſagreeable flavour than the rhubarb.

There are two kinds of rhubarb at preſent brought to England, the one is called the Turky kind, which bears much the higheſt price, being in general of finer appearance; the other the Ruſſian, but now more frequently brought from China. As the latter is commonly brought in the private trade, by the perſons employed in the ſervice of the India company, it is purchaſed of them, in large parcels, at a very low price, by thoſe who are in the ſecret of this advantage; and by them ſorted into different kinds. The beſt pieces being picked out, and cut into a proper form, and freed from all worm eaten, or other depraved parts, is ſold for Turky rhubarb;

and the next beſt under ſome other proper denomination; while the worm-eaten, or other unſightly parts, are uſed for tinctures or ſyrups: and, by this management, a very conſiderable profit is made.

### *Subſtitution for bezoar.*

The oriental bezoar being of great price, the gall ſtones, found in the gall bladders of oxen, are frequently ſubſtituted for it; being of the ſame nature: but, as even theſe are ſcarce, and not to be procured frequently, the gall itſelf of oxen, or ſheep, is moſt uſually put in its place.

It is not, however, of any moment, what innocent ſubſtances are uſed in the place of bezoar: the medicinal virtues of it being imaginary; and the drug itſelf now ſo little conſidered, in any regular practice, that it is excluded from the materia medica in the laſt edition of the college diſpenſatory.

The true bezoar itſelf may be diſtinguiſhed from the gall ſtones, or any artificial compound, by its appearance only: but its effect may be eaſily counterfeited, by ſeveral means,

means, in compoſitions where it is uſed, ſuch as the Goa ſtones, or Gaſcoign's powder, ſo as not to be diſtinguiſhed; whatſoever may have been formerly thought to the contrary. The effect here ſpoken of is the making teſtaceous, or other ſuch like bodies, give a yellowiſh green colour to paper, when rubbed on it; which has been generally eſteemed a certain proof, that any compoſition contained a due proportion of bezoar.

They, therefore, who are deſirous to have thoſe medicines genuine, in which the bezoar has a part, muſt prepare them themſelves; or, otherwiſe, they can never be certain, that they are not impoſed upon in this particular.

*Aduteration of gum-reſins, gums, and balſams, in general.*

The gum-reſins, and gums, in general, which make ſo large and important a part of the materia medica, are extremely liable to ſophiſtications, by diſſolving them, and, in ther reduction to a dry conſiſtence, commixing with them heterogeneous matter, either reſembling the gum-reſins or gums themſelves, or ſuch foulneſs as is natural to them

from the manner of their production. But, as this admits of a great variety of circumſtances, it is impracticable, to lay down any particular rule, for the judging of, or proving, the purity, or genuineneſs, of ſuch ſubſtances. The eaſieſt method is, to compare each kind with a well choſen ſpecimen; by which, the degree of foulneſs from bodies wholly heterogeneous, or alteration in the apparent qualities by any ſophiſticating mixture which has greater affinity with them, will be beſt perceived.

The purification, by ſolution in the proper menſtrua, may be, however, uſed, where it is of great importance, to know, particularly, the proportion of feculencies, that may be contained in any parcel in queſtion.

The balſam of capivi; as alſo the Chio, and Venice turpentines are very often ſophiſticated with the common turpentine; and it is frequently ſubſtituted intirely in their place, in compoſitions.

The balm of Gilead, balſam of Peru, and others of a dear kind, are, likewiſe, very ſubject to be adulterated, by mixing turpentine,

tine, or ſome of the cheaper kinds, with the dearer.

While they are alone, the ſeveral ſpecies of the terebinthinate genus are diſtinguiſhable enough from each other: but, when they are compounded with each other, or mixt with bodies of a different nature, it is very difficult to determine certainly with reſpect to the genuineneſs; any further than can be done, by their peculiar ſcents; to judge the better of which, it is always proper to have ſpecimens of ſuch as are known to be good.

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